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Physiological Effects of Electricity. PROF. HOUSTON adds this week to the discussion on the effects of electrical currents on the human system a very able re-statement of his views on the general subject, and of the reasons why he believes in electrolytic action as taking place in the body as the result of receiving a heavy current. There is, indeed, as he says, a fruitful field of investigation opened up for the physiological laboratory.

The Acoustic Telephone. A GREAT many of our readers will be interested in the article contributed this week by Mr. G. F. Shaver on the evolution of the acoustic telephone, dealing with the principles involved and the manner in which he has sought to apply them. The various means of improvement to which attention is drawn are all of them worthy of note, and the suggestion thrown out as to the way in which the distance at which an acoustic line will work may be greatly increased seems quite new.

A Novel Galvanoscope. As ocular demonstration is the best way of informing the student as to the action of the physical laws, the construction of physical apparatus has sometimes led to forms of very queer shape. An instance of this, and a decidedly interesting one, is the galvanometric battery illustrated in another column. While the existence of the current in the external circuit can be readily shown in a variety of ways, the current within the cell itself is rather difficult of demonstration; but the apparatus described and illustrated in another column solves the problem in a very neat and ingenious manner.

Underground Electric Roads. NOT satisfied with their excellent prospects above ground, electrical engineers are now pursuing their vocation in subterranean depths, and they have supplemented successful electric lighting there by electric railroads. We illustrate in this issue a road now working in the lower drift of the celebrated Lykens Valley mines at a distance from the mouth of no less than 6,300 feet. This is the second installation of the kind made in these mines by Mr. W. M. Schlesinger, and we cannot refrain from congratulating that energetic young engineer on the success that has attended his pluck and skill. We believe that the number of mine roads will soon be very largely increased. Their economy and their practicability are already proved beyond all question.

What is Diamagnetism? ALMOST simultaneously with the publication of the second edition of Tyndall's researches in diamagnetism, attention is drawn to a series of experiments that are again claimed to controvert the theory of diamagnetism as generally accepted. According to the new theory, the action of diamagnetism is not due to a dissimilar polarity which the magnetized bodies assume, but their state when magnetized is influenced by the medium which surrounds them, depending upon whether that medium is more or less magnetic than the body itself. The experiments which are given in another column are certainly worthy of further investigation, and we hope that Professor Tyndall himself may find time to investigate these phenomena and trace their origin.

Difficulties of Patent Protection. ANOTHER argument in favor of the patent reform which is desired by so many inventors and others interested in electrical applications is presented with much force this week by Mr. W. D. Baldwin, in an article calling attention to the fact that as matters now stand a corporation must be sued in its own State. As Mr. Baldwin says: "One result of this radical change will be that an Oregon corporation committing an infringement in New York will have to be sued in Oregon. The practical inconvenience needs only to be suggested. * * * Practically the effect would be in many instances to sue the user and not the maker or the seller; but if the user of a machine in New York had his domicile in California, it would not help matters very much." Even if there should be no Patent Court for the trial of patent cases, here at least is an evil to be abolished in the interests of the patent system.

A New Alternating Current Dynamo. WHILE, generally speaking, constructors of alternating current machines have drawn largely on the older styles for their patterns, and sought to improve them by modifications of details suggested by modern practice with continuous current machines, we record this week a departure from this method, and a striking out upon a new design. Mr. Mordey has evidently started out with the idea of avoiding the use of iron in the armature, and for this reason primarily adopted a design in which the armature coils should occupy as little space as possible between the poles and the field magnet. In this construction the loss entailed by the magnetic resistance of the air is reduced to a minimum. Again, the excitation of the revolving field magnet by a single coil avoids complication, and seems to be another factor in the high regulating qualities claimed for the machine. Altogether the design is well worthy of study, and it is interesting to note that, according to report, the first machine built, although of the large size illustrated, realized fully the calculations of the designer.

The Telephone in St. Louis. WE do not wonder that the telephone people in St. Louis propose to quit business, nor that so many of the subscribers are anxious to have them stay. Mr. Durant is one of the best telephone managers in the country, and he has always given a splendid service, for which the old rate of $100 a year was none too much. We have tried the service more than once, and know that it is hard to beat for general efficiency. Now, however, the local company is told by a recent ordinance that it must lower its rate to $50 a year, and it has been fined for not doing so. Such a proposition is an outrage, to be fought against without reserve or compromise. A special dispatch says: "The company assert that they will not take advantage of any scheme to evade the law, though many subscribers whose contracts have expired are willing to pay the full rental demanded, and will do it by donation or otherwise, so that they can have the use of the wires." In face of this, the official programme is that of cutting down the poles and wires. Surely we may expect something better than that from a great city like St. Louis. Such a policy is as barbaric as that of destroying railway tracks and burning down factories to remedy industrial troubles and grievances.

Central Station Opportunities. THE discussions which have been going on regarding the relative value of the alternating and the continuous current, have brought out an interesting point. The matter is one which, though at first it seems a side issue, may play an important rôle as a source of profit to central stations in the future. Thus it is claimed that systems employing current of low tension are obliged to locate within or close beside the district which is to be supplied; and hence the cost of production of power is greatly increased over stations which can be situated close by railroad sidings, or where water for condensing purposes is available. The point to which attention is drawn is that the heat ordinarily wasted in the escaping exhaust steam can be utilized for heating and be distributed to consumers within a reasonable distance of the station. We know of several instances in which that is now being accomplished, and it is highly probable that we shall hear more of this line of work in connection with central station lighting than heretofore. But, though primarily broached as an argument in favor of stations for the distribution of low-tension currents, the principle remains the same for both and all systems, where stations are situated within populous districts; so that all electric light stations thus placed may take advantage of the idea. The electric light station will then be, as it should, the source of light, heat and power, all three of which will be furnished in the most available and safest form.

Rapid Transit in Large Cities. ONE of the greatest evils in our modern large cities is the overcrowding, and one of the greatest wants of the day is easy rapid transit, so that the area of domestic occupancy may be enlarged. No one will claim, we think, that a settlement of all the troubles involved in this subject has been reached by existing systems, whether the London underground or the New York elevated, which represent the extent of practical development up to date. In each case, the objectionable features, we believe, are mainly those connected with the use of steam, direct, with its attendant noise, fumes and dust. Some cities have sought relief from the annoyances of steam in the intermediary service of the cable, but this again, being but one vast unit, where there should be independence for each car or train, had its serious objections. At this point, the electrician steps in and offers a method that he believes equal to the emergencies, and to be the best qualified to meet the most advanced ideas of convenience in urban travel. He is now at work in all directions, and in various ways, showing what he can do or proposes to accomplish. This week we illustrate and describe the heaviest piece of electrical engineering yet attempted in this department, the road at Richmond; and from the results there obtained, the brightest auguries may be drawn. At any rate, an electric railway that is carrying nearly 75,000 passengers a week this summer is so far beyond the experimental stage, even admitting notable improvements to be necessary and likely, that the future of rapid transit in cities can be discussed only with an inclusion of the electrical method. We are glad, therefore, that Mr. Frank J. Sprague is to bring the matter before the American Institute of Electrical Engineers next week. The title of his paper, "The Solution of the Municipal Rapid Transit Problem," at once challenges attention, public as well as professional, and we have no doubt that its handling will be worthy the occasion. Mr. Sprague has an excellent opportunity to earn the praise and gratitude of all interested in the important field of electric railroading by his presentation of the engineering and economic data and arguments upon which this latest application is based, and the time is ripe for the appeal that he will make in behalf of the overcrowded populations of the big cities.

Meeting of the Railway Telegraph Superintendents.

We are in receipt of the following from Mr. C. E. Topping, of 82 Broadway, the general superintendent of the New Jersey Division of the United States Express Company:

"We would be very glad to have you notice the time of the next annual meeting of the Association of Railway Telegraph Superintendents, at the Murray Hill Hotel, New York, July 11, 1888, and say that exhibitors of electrical devices are invited to confer with any of the following named gentlemen of the committees:

"Committee on Electrical Devices.—Charles Selden, Esq., Chairman, Baltimore, Md.

"Committee on Space.—Messrs. W. J. Holmes, S. S. Bogart, or C. E. Topping, New York."

The meeting promises to be very enjoyable, and to be largely attended.

On the Causes of Death by the Electrical Current.

BY PROF EDWIN J. HOUSTON.

The issue of THE ELECTRICAL WORLD of May 26, 1888, contains a short article by Dr. Robert Amory, in which he calls in question the correctness of certain statements made by me, republished in THE ELECTRICAL WORLD of May 19, 1888, as an abstract from the proceedings of the American Philosophical Society.

The statements made by me were, briefly, that death by the electric current results either (1) from shock, or (2) from electrolytic changes produced either in the blood itself, or in other tissues of the body.

Dr. Amory objects to these statements, and is unwilling to allow them "to go unchallenged in the light of physiological knowledge as possessed by medical men of the present day. According to this knowledge, acquired by experiments in animal life, as well as by observation of pathologists on the appearance of human bodies of those who have been destroyed by lightning and strong electrical currents, medical men are of the opinion that *most generally death by electricity is caused by asphyxia* (my italics) rather than by any chemico-physical effects on the living tissue."

From the above, which is quoted from Dr. Amory's article, it would appear that in his opinion:

1. Medical men are agreed that the cause of death by electricity is fully known; and

2. That such cause is asphyxia.

There can be but little doubt that the medical world in general will not heartily subscribe to these opinions.

Though I do not claim any more than a general knowledge of physiology, yet I will venture to dissent personally from the principles thus broadly laid down by Dr. Amory.

In support of his opinion, Dr. Amory states that "the comparison of post-mortem appearances of the body of an animal destroyed by electricity shows a similarity with the appearances of the body of individuals destroyed by drowning or other forms of death by asphyxia." There is justification, therefore, for the belief that the word asphyxia is here used to designate abnormal respiration resulting from the absence of a due supply of air.

It would seem, to a non-medical mind, that the rapidity with which death follows the passage of powerful electric currents, would necessarily preclude the assigning of the absence of a proper air supply as the immediate cause of death. It would rather appear that death, or suspended animation, is the cause of the lack of a proper air supply. If this be his meaning, then it would appear that an *effect* has been erroneously ascribed as the *cause* of a phenomenon, and the question still remains as to the true nature of the cause.

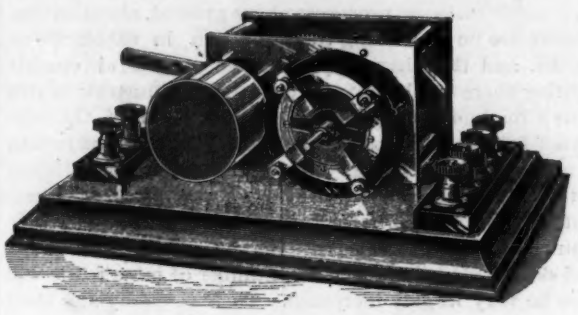
As I very distinctly stated in my remarks to the American Philosophical Society, death from electrical currents may result from shock. "When any part of the body is placed in the path of an electric discharge, more of the discharge will pass through the better conductors, which perhaps will, generally, be the great nerve trunks and muscles. Reference must, therefore, be had to the position of such nerve centres, as well as to the heart, the lungs and the viscera and other vital organs."

That powerful electric discharges sent through a great nerve trunk, as for example the pneumogastric, would stop the heart action, or through the respiratory or circulatory centres would produce similar results, there can, I think, be no doubt. In the case of the pneumogastric, comparatively weak currents may cause fatal results. And, indeed, as Formad has shown in two post-mortem examinations of death by electricity, there have been actual hemorrhages in the fasciculi teres in fourth ventricle; also ecchymoses in the lining of the other ventricles. My explanation, therefore, of the cause of death does not appear to differ so very radically from "the more correct explanation of death by strong currents of electricity," so confidently announced by Dr. Amory, save that I have not perhaps, so unfortunately mistaken the *effect* for the *cause*.

There is one point, however, where I must take exception to the statements made by my critic. He says: "The animal functions of muscular contraction are thrown into a strong tonic spasm, which will prevent the free respiratory movements which are essential to life. If these conditions are maintained for a sufficient period of time the natural movements of respiration are delayed long enough to suspend the movements of blood in the capillary circulation." If this purely mechanical conception of respiration be correct, would it not appear that the surest protection against electrical asphyxiation, as claimed by Dr. Amory, would be to provide the person of the patient with an electric motor, so that the same discharges that stopped breathing (mechanically?) should protect him by supplying power for extra mechanical respiration.

The only question, then, that remains between Dr. Amory and myself is whether, or not, electrolytic changes do, in fact, take place in the blood or other tissues in cases of death by electricity. Such a question cannot be settled by a mere matter of opinion, but necessitates careful post-mortem examination, and even, in some cases, microscopical examination of post-mortem tissues. At the same time, bearing in mind the fact that a very small electromotive force is capable of effecting the electrolysis of most of the materials found in the tissues of the body, it is difficult to see how discharges of several thousand volts, or, indeed, even of several hundred volts, can possibly pass through the body without electrolyzing some of its tissues; though, of course, in the present stage of our knowledge, whether such electrolytic changes precede, accompany, or follow death may, perhaps, be considered doubtful.

As early as 1745, Dr. Tiberius Cavallo, in his work on electricity, pointed out the fact that in cases of death by severe electric shock the muscles failed to be convulsed by the subsequent passage of an electrical current, and this observation, I believe, stands to-day uncontradicted. This

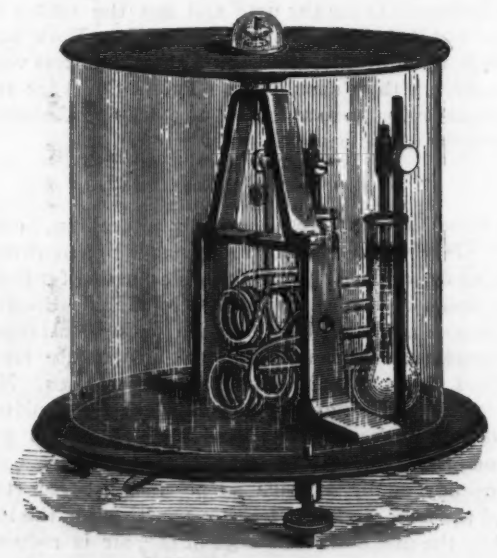


NEW FORM OF SECOHMMETER.

fact, assuming its truth, would appear to prove that an actual change, presumably electrolytic, occurs in such cases in the tissues.

I fail to comprehend the point of Dr. Amory's inference, that because the bodies of those killed by electricity do not decompose any more rapidly than those who have died from other causes, therefore no electrolytic decomposition could have occurred. Since electrolytic changes in general would result in the formation of simpler molecular groups, it would naturally be expected that to the extent that the electrolytic changes that occur in the blood could produce any effect on the rapidity of subsequent decomposition, would be to cause them to occur less rapidly after than before such electrolytic action.

It should here be pointed out that in many cases the electrolytic changes may be incomplete when death ensues. That is to say, the first step only may be set up; namely, the polarization of the electrolyte, which is thus placed in a condition of molecular strain, while the second step, the molecular decomposition and interchange along the polarized chain, may not yet have begun. This strain, or polarized condition of the tissues of the body, may not prove an improbable factor in the cause of death. In such cases, the polarization may be destroyed, possibly, by some of the means ordinarily employed for resuscitation in cases of apparent death by drowning; though, perhaps, with greater certainty, by a plan first suggested, I believe, by Prof. Elihu Thomson, in which the same cur-



THE GALVANOMETRIC BATTERY.

rent that causes unconsciousness is sent in the opposite direction through the same parts of the body that were traversed by the original current. Here there would appear to be a fruitful field for investigation in the physiological laboratory on the bodies of the lower animals.

My critic, Dr. Amory, is, I believe, the author of a book entitled *A Treatise on Electrolysis*, published in 1886, in New York. I quote the following passage verbatim from page 71 of this work:

"It is well known that there are two systems of electrical force, by means of which heat and illumination may be obtained from its action on the inorganic substance; reference is here made to the two methods of procuring light from the passage of an electrical current through the resistance of carbon, by means of a current of low tension and one of high tension in the arc light. In these physical illustrations carbons may be heated to a state of incandescence by means of a current which, passing through the human body, may destroy life, or which, passing through the human body at low tension (the Daft system) may not be felt by the person acting as a conducting medium; in both instances the same physical effect is produced on the carbon, which is in a high state of illumination."

I am not sure of the exact meaning of this remarkable passage, but believe that the author intends to assert that in the Daft system, the same current that produces the light of the incandescent lamp may be safely passed through the human body. If this be the meaning, I doubt very decidedly the correctness of the statement. It is true that under certain conditions the terminals of an incandescent dynamo, with lamps in multiple-arc circuits, may be touched with impunity, since the high resistance of the human body would, ordinarily, prevent any but a very small proportion of the current from passing through the body. Even under such circumstances, the experiment is far from being devoid of danger, while to subject any considerable part of the body to the passage of a current would be both foolhardy and dangerous.

A Galvanometric Battery.

The student in electricity is taught that the current flows from one pole of battery through the external circuit to the other pole, and then across the liquid element of the cell to the first pole. This is easily demonstrated to him as regards the external circuit by the aid of a galvanometer or electro-magnet. But the existence of the current in the liquid cannot be so well shown, and usually no attempt is made to reveal its presence. To supply this defect in our educational apparatus, says *Engineering*, Mr. Conrad W. Cooke devised the exceedingly ingenious galvanometric battery which we illustrate. It is of the type of the Thomson reflecting instrument, but instead of the magnet being surrounded by a coiled copper conductor, it is placed among the convolutions of four glass tubes. These tubes are filled with the liquid element of a galvanic cell of which they form a part. At each end they are sealed into a glass vase; one vase contains a zinc rod and the other a carbon rod immersed in dilute acid, which also fills the tubes. Evidently, if the current flows from one electrode to the other, as it is supposed to do, it must traverse the four parallel glass tubes, and in so doing it will affect the magnet of the galvanometer. This is exactly what happens. When the external circuit is completed the mirror is deflected, and the spot of light which it reflects moves along the scale. This apparatus, which is a fine example of glass-blowing, is a notable addition to an educational laboratory. It was constructed by Mr. C. H. Gimingham.

A New Form of Secohmmeter.

At a recent *conversazione* of the Salters' Company in London, a new direct reading secohmmeter of Profs. Ayrton and Perry was shown. This has been designed as a cheaper form than the older instrument, and is intended to be used in comparison of the coefficients of self and mutual induction. The apparatus, with the cover removed, is shown in the accompanying illustration, taken from the London *Electrician*.

In the earlier forms of the secohmmeter only a make-and break were successively made in the battery circuit and the circuit of a shunt to the galvanometer, but by the use of the double commutator in the new form of secohmmeter, the sensibility of the arrangement is increased fourfold. For if there be any want of balance in the coefficients of self or mutual induction that are being compared with one another, or with the capacity of a condenser, the galvanometer receives an impulse in the same direction at every reversal of the battery, which impulse is twice as great and occurs twice as often as if the galvanometer needle received an impulse either only at the making or at the breaking of the battery circuit, as in the earlier forms of secohmmeter. The fly-wheels make 10 revolutions for every revolution of the handle, and, although by the simple alteration of the gearing previously referred to the commutators can be driven at will, so as to make either two reversals or eight reversals for every revolution of the handle, the ratio of the speed of the fly-wheel to the speed of the driving handle always remains the same, so that the fly-wheel action remains constant. The driving handle can be conveniently turned by hand at speeds varying from about 60 to 200 revolutions per minute, producing with one arrangement of the gearing 120 to 400 commutations per minute, and with the other arrangement 480 to 1,600 commutations per minute; so that both the battery and the galvanometer circuits can be conveniently commutated from about 120 to 1,600 times per minute, the lower speeds being used for circuits having a large time constant, and the higher for circuits with a smaller time constant. The exact range of commutation, however, is made different in the various secohmmeters intended for different purposes.

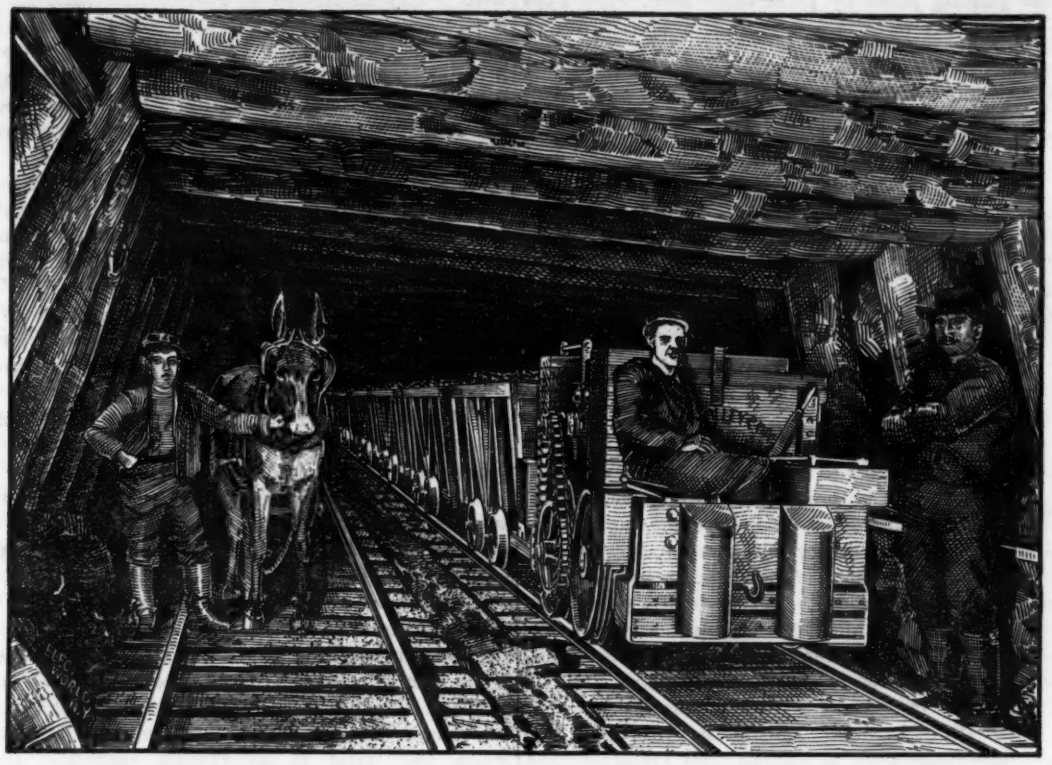
When the instrument is intended to be employed for absolute measurements of a coefficient of induction or the capacity of a condenser in terms of a resistance and a time, a speed indicator is attached to the spindle seen projecting from the commutator in the figure. But for comparison of the coefficients of self or mutual induction with one another, or with the capacity of a condenser, no speed indicator is necessary.

Another use to which the secohmmeter can be put is the measurement of the resistance of a liquid which is

liable to polarize with direct currents, but which, as is well known, will not polarize with rapidly alternating currents.

The Electric Railway in the Lykens Valley Coal Mine.

Our columns have already contained descriptions of the Schlesinger electric railway operated in the Lykens Valley coal mine. We now present, in the accompanying illustration, a view of the motor "Pioneer," standing on a turn-



ELECTRIC ROAD IN THE LYKENS VALLEY (PA.) COAL MINES.

out 6,300 feet inside the mine, and ready to haul out a loaded train. A second electric motor has recently been put to work, which has on one occasion hauled 33 cars, against 31 as a maximum thus far hauled by the "Pioneer."

The daily work performed by the old motor has increased from 40 cars a day last summer to 117 cars recently hauled during one day. These cars were hauled out in 8 trips, one of 20 cars, two of 18 each and the rest varying between 12 and 15. The total work performed on that day represented 950 mile tons; these figures do not include the work performed in switching the loaded as well as empty cars on the turnouts. The maximum number of trips made in one day of 9 hours was 17.

On a recent Sunday a fire had broken out inside the mine in the lower workings, access to which could only be had through the drift in which the "Pioneer" runs. A steam locomotive and the "Pioneer" were at once ordered to be put at work, the first to haul men and supplies from the different points of the mine on the outside to the drift mouth; the other to take them inside to the turnout, from where men took the supplies to a point near the fire. In about five minutes the "Pioneer" was at work, and three to four hours later the steam locomotive was ready (they having extinguished their fire on Saturday night). The "Pioneer" remained at work with but few intermissions from 7 o'clock Sunday morning until 9 the next morning. Up to 12 o'clock Sunday it had made twelve round trips, having sometimes run at a speed of from 15 to 20 miles per hour. The shortest time for a round trip, including the necessary shifting of the loaded, as well as empty cars, was 18½ minutes.

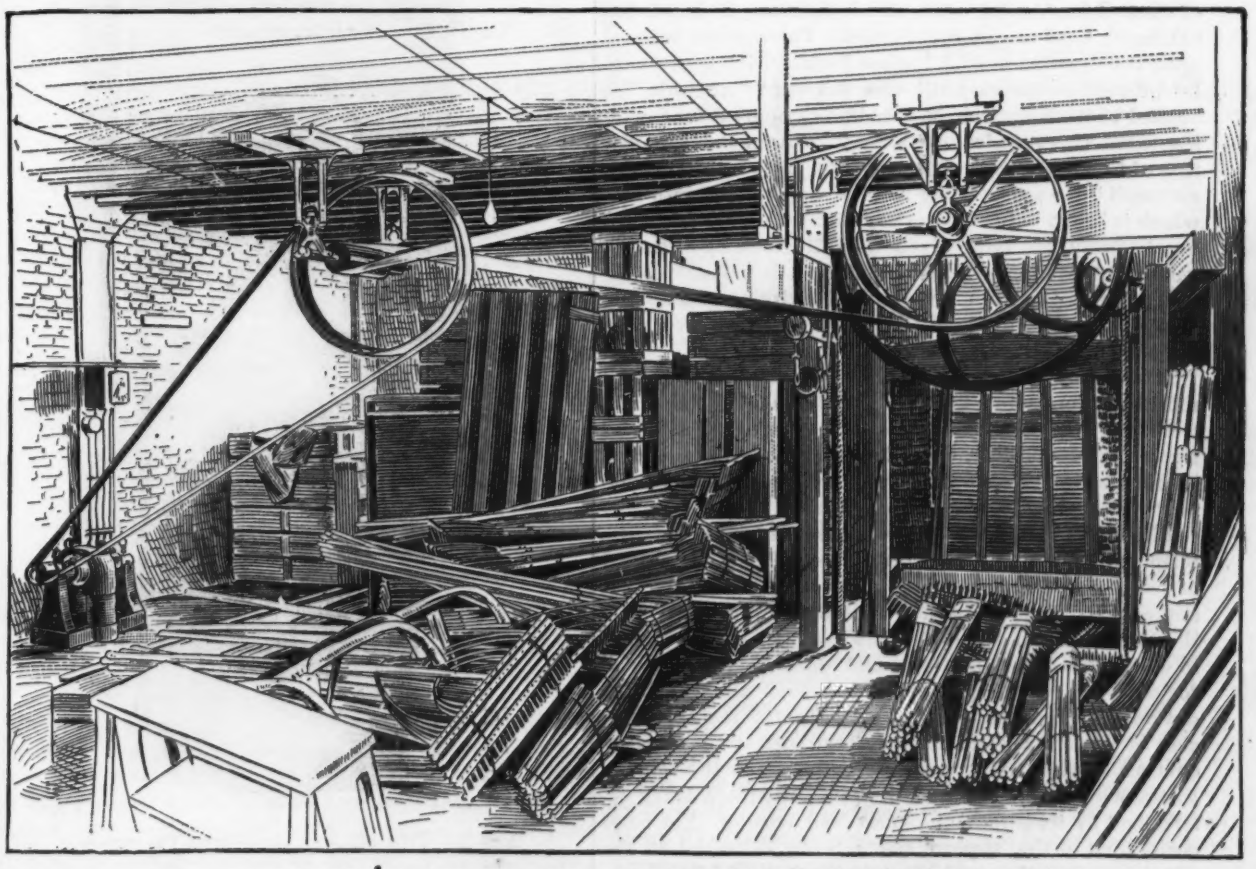
As stated above, the maximum number of cars thus far hauled in one day is 117; but it is expected to increase this to 200 before the close of summer, and if the expected amount of coal is found this may even be increased to 250. The work of the new motor is 300 cars per day, representing 2,400 mile-tons.

Last week a fan 7 feet in diameter was started, situated on the hill 3,000 feet from the generator, and run by a small motor day and night.

Other applications of electricity to mining work are also actively being made in the Lykens Valley mine, and parts of the works are now being lighted by electricity. There is also being tried a drill which has drilled a hole 2 inches in diameter, a distance of 3 feet in 31 seconds, and a 6-foot hole of the same diameter in one minute and a half, including the time necessary for changing augers. All this work is being undertaken by the Union Electric Company, of Philadelphia, of which Mr. Wm. M. Schlesinger is the electrician.

Operation of Elevators by Electricity.

We illustrate on this page one of the many uses to which the electric motor has been applied. This field of work is one that receives daily more and more attention, and which is rapidly assuming great importance. The cut shows the elevator in the agricultural implement warehouse of Bartlett & Low, Lowell, Mass., where the Thomson motor was installed by the Thomson-Houston Electric Company about the middle of February last. Since that time it has been in regular operation running the elevator, which is a large one, with a platform 9 feet by 5. The users are very well pleased, and say: "The motor has run our elevator perfectly for three months now and has never failed to do all that we have asked it to do, and that is a great deal more than you warranted it to do." The care and trouble have also been insignificant. The Thomson motor is also being introduced now for passenger elevators, one instance being that of the Central National Bank of Washington, of which an expert reports: "I have never witnessed better results from power than this motor is developing, being perfectly steady, without noise or disagreeable odor, which are objections to other devices furnishing power. I saw the motor subjected to some severe tests in starting it with the whole load on; tests which fully convinced me that it is all that is required for power purposes." It must be evident to all who give the subject any study, that the introduction of electric motors will render highly valuable much property now used for office purposes, but yielding at present only small rents because of the absence of elevator accommodation. The same remark applies to apartment houses, especially in a city like New York, where there are so many such blocks within easy reach of central stations.



ELECTRIC ELEVATOR PLANT IN A WAREHOUSE AT LOWELL, MASS.

Western Union Earnings.—It is reported that the Western Union Company is now earning at the rate of 8½ per cent., so that a reduction of dividend is improbable.

The Act of March 3, 1887, and How It Affects Patent Practice.

BY W. D. BALDWIN.

The Act of March 3, 1887, probably sprung from a desire to limit the jurisdiction of the Circuit Court in what are known as "removal cases." It is one of the too frequent instances of careless legislation, characteristic of Congress.

The act is fully discussed in Speer's "Removal Cases," a recently published monograph.

Prior to the passage of this act, in cases dependent upon subject matter, such as patents, the defendant could be sued wherever found at the time of serving the writ. The recent act now requires that the defendant shall be sued in the district whereof he is an inhabitant.

The terms of the act are: "No civil suit shall be brought before either of said courts against any person, by any original process *of* (or) proceeding, in any other district than that whereof he is an inhabitant."

It has accordingly been held, in Reinstadler vs. Reeves, 33 Fed. Rep., 308, that a citizen of Indiana cannot be sued for infringement in Missouri, and that he did not waive his right to demur to the jurisdiction by entering a general appearance.

The interest of the question, however, centres largely on suits against corporations, concerning which there are numerous decisions.

Corporations are conclusively presumed to be citizens and residents of the State creating them.

Railroad Company vs. Wheeler, 1 Blatch., 286.

Railroad Company vs. Harris, 12 Wall., 65.

Railroad Company vs. Whiton, 13 Wall., 270.

Schollenberger, 96 U. S., 369.

National Steamship Company vs. Tugman, 106 U. S., 108.

County of Yuba vs. Pioneer Company, 32 Fed. Rep., 183.

A corporation resides in all the districts of the State creating it; (Locomotive Engine Safety Truck Company vs. Erie Railroad, 10 Blatch., 292; 3 Off. Gaz., 93); so that, for instance, a New York corporation could be sued in either the Northern or Southern District.

When a foreign corporation is considered an inhabitant of a State outside of the State creating it:

U. S. vs. Telephone Company, 29 Fed. Rep., 37.

St. Louis Company vs. The Consolidated Barbed Wire Company, 32 Fed. Rep., 802.

Whether a foreign corporation can be served in New York was suggested, but not decided, in Maynard vs. Green, 30 Fed. Rep., 644.

In Carpenter vs. The Westinghouse Air Brake Co., 32 Fed. Rep., 434, it was held that the presence of the chief officers of a foreign corporation in another State, conducting operations and exhibiting the invention, did not confer jurisdiction.

In St. Louis Wire Mill Company vs. The Consolidated Barbed Wire Company, 32 Fed. Rep., 802, it was held that an officer of a foreign corporation visiting a State on the business of the company did not bring the corporation with him.

In Fales vs. Railway Company, 32 Fed. Rep., 673, it was held that corporations are citizens of the State creating them, and cannot acquire residence in another State by engaging in business there, and that suit must be brought in the district of residence.

This case was followed and approved in Loomis vs. New York & Cleveland Gas Coal Company, 33 Fed. Rep., 353.

St. Louis, etc., Railway Company vs. Terre Haute Co., 33 Fed. Rep., 385, holds that defendants must be sued in the district of his domicile.

In Halstead vs. Manning, a recent unreported case, Judge Wallace held that a Connecticut corporation having a place of business in New York City could not be sued in New York.

One result of this radical change in the law and in practice will be that an Oregon corporation committing an infringement in New York will have to be sued in Oregon. The practical inconvenience needs only to be suggested.

Of course, the seller or user of an infringing device can be sued in the district where he resides, but this would be of small benefit in the case of an Oregon corporation sending an inhabitant of Oregon to New York to commit the infringement. Practically, the effect would be in many instances to sue the user, and not the maker or seller; but if the user of a machine in New York had his domicile in California it would not help matters very much.

However, whatever the consequences may be, they have to be faced, and it is well to understand what they are in order to do this advantageously.

A large number of cases in the 32 and 33 Fed. Rep., bearing on the removal question, have not been noticed because they relate to cases dependent upon citizenship, and, while they indirectly bear upon this question, those cited embody, it is believed, all the reported decisions bearing directly upon the question discussed.

The Evolution of the Acoustic Telephone.

BY GEORGE F. SHAVER.

Comparatively few people are to-day aware of the perfection to which the acoustic telephone has been brought. Fewer still have any conception of the labor that has been bestowed upon it, and scarcely one in a thousand is familiar with the laws governing the phenomena observed in its use. But few of the many patentees of devices of this kind have understood the problem before them, as their work would seem to prove, nearly all of it being simply modifications of the so-called "lover's telegraph," which consist of a string of wire suspended between two parchment diaphragms and secured by a contact button resting against the diaphragms.

The general idea of the acoustic telephone even at this late day is that it is a very imperfect and unsatisfactory instrument, working tolerably well only under the most favorable conditions, and confined to a very short and straight line and incapable of transmitting the voice with any degree of distinctness during rain or wind storms, besides being extremely liable to get out of order. This opinion is based upon the experience with various forms of the instrument by different designers, until now the word "acoustic," as applied to the telephone, has become a synonym for worthlessness. This is unfortunate, as it retards the introduction of the perfected instrument now that it is "un fait accompli," the public being loath to experiment with that which it has so long considered a failure. This species of humbuggery has been given its full scope by dishonest vendors of inferior apparatus, and as it is possible to obtain some results from almost any description of sounding board and tight wire, many new ones have appeared, only to be displaced within a short time.

The lack of success which has attended the efforts of most inventors in this field was not so much a lack of native ability as it was the absence of any well defined laws governing the subject, and the apparently contradictory results obtained by the same apparatus under varying conditions. Perhaps no branch of physical science presents so discouraging an aspect to the experimenter. An acoustic telephone line in its simple and common form is composed of two diaphragms located at a distance from each other and connected by a tight line. If all that was necessary was the conveyance of vibrations, it would be a simple matter to design a sensitive line wire and resonator, or telephone, for each end; but experiment with such an instrument develops the fact that it is utterly unfit for the transmission of speech, as each span of tight wire in the lines becomes a musical string, and when vibrated by the voice or by the wind, sets up a musical sound, the pitch being determined by its length, thickness and tension. The composite tone of the several spans being delivered at the telephones, together with the vibrations caused by speech, causes indistinctness, and during wind storms the sounds are entirely unintelligible.

My own attention was first called to the subject during the year 1875, while constructing a short telegraph line from my office to my house, a distance of about 500 feet. The wire was supported only at the ends, swinging over a sort of valley, and was fastened with a screw eye to boards resting across the window sills. When the telegraph instruments were connected I noticed that whenever the window at my house was raised, I could plainly hear the noise in the office, also the sound of persons walking in the room. I accidentally discovered that rapping upon the supporting board would attract the attention of the people at the other end of the line, and upon examining closer and halloing near the board, indistinct words could be heard. I considered it of no importance and did not experiment further with it except to twist an insulated copper return circuit wire together for the main line, when I found the telephonic sounds were clearer. This I believe to be the first instance on record of the use of twisted or insulated wire upon a telephone circuit, though at that time I used it with but little satisfaction. During the Centennial year my interest was greatly awakened by the reports of Prof. Bell's experiments, and I then commenced experimenting with the acoustic telephone, and have given my entire attention to it since, each year gaining point by point until now, when I am able to say that the work is complete, and an instrument

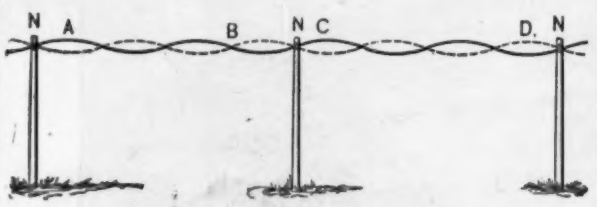


FIG. 2.—IDEAL LINE FOR ACOUSTIC TELEPHONY.

of absolute certainty of action is produced, working as well over crooked as straight lines, and practically unaffected by either wind or rain.

The first real step towards an increase of power and sensitiveness in this class of telephone was taken by Mr. Schuyler S. Parsons, of Chatham Centre, Ohio, who, departing from the old principle of a single connection to the diaphragm known as the button telephone, and by branching the line wire into a cone of several wires whose base rested against the diaphragm, secured greater power and increased sensitiveness, and by using silk for the diaphragm. This, while increasing the power of transmission, increased its sensitiveness to external vibrations, and the telephone became famous as an accomplished "howler" during even slight breezes. During the year 1879 Mr. Holcomb, then postmaster at Mallet Creek, Ohio, brought out my old experiment of twisted wires and his telephone was largely sold throughout the country under the name of the Amplifying Telephone. This instrument was strong and durable, but required most careful adjustment and was limited to nearly straight routes and was indistinct during wind storms, and also gave out a rushing sound.

At about this time I discovered that a hanger having several points of connection enabled angles to be turned

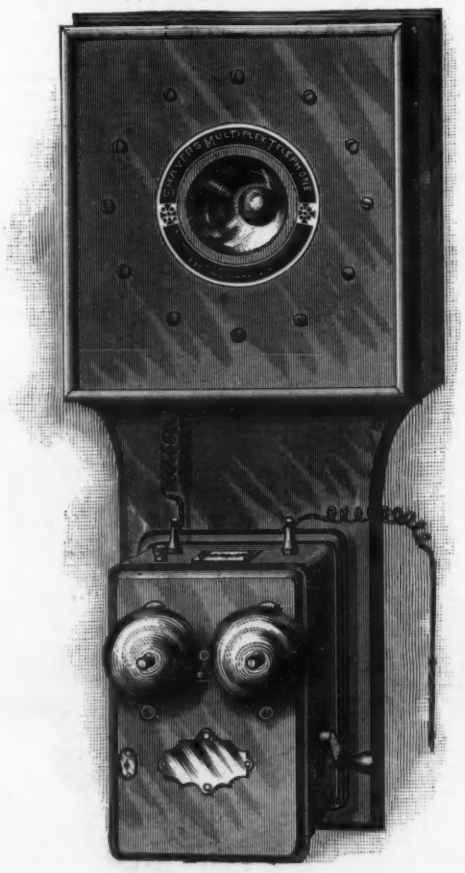


FIG 1.—THE SHAVER ACOUSTIC TELEPHONE.

with but little loss of power, and, soon after, I found that nearly all reverberation could be checked by immersing the wire in paint, "Ulesote" being found to answer best. About the year 1881 Mr. John B. Bennett, of San Luis Obispo, Cal., designed a receiver for concentrating them to the ear by means of a flexible tube, and later, simultaneously with myself, brought out the single insulated acoustic wire which did away with the resonance or reverberation of the line wire. But it had this fault, that when saturated with water during rain storms its efficiency was greatly impaired, and upon lines of one thousand feet or more became almost inoperative.

During the years 1880 to 1886 inclusive, my attention was chiefly given to the development of a central exchange apparatus, and in the latter plans good results were achieved, lines being successfully connected and operated in any direction for a distance of one-half mile from the central office. This exchange was in use at the office of the Consolidated Telephone Co. for a year or more in the City of New York, and for four months in daily use at Tiffin, Ohio, when it succumbed to the great telephone monopoly and was withdrawn.

During the year 1885 I found that a cable composed of a number of wires twisted about a fibrous core obviated all resonance, and was effected but little when saturated with water. Not until 1887, however, was the secret of a wire totally unaffected by atmospheric influences discovered, but that it exists is now an open secret to all users of my later apparatus. During this year I also made a discovery which, I am inclined to think, has brought the acoustic telephone to perfection. It was the discovery of the combination of a parabolic reflector terminating in a vibrator to which the line wire is attached, the ordinary diaphragm being entirely done away with and an annular ring taking its place. These three elements are supported behind a sounding board which has an aperture at its centre, the focus of the reflector being at the centre of the aperture.

With this arrangement, shown in Fig. 1, it is possible to collect and deliver the ordinary lateral vibrations of the line wire at a focus, and, in addition thereto, to utilize the molecular vibration of the line wire and connecting elements. The result is striking in the extreme, permitting, as it does, of talking over lines a mile in length and with various angles with great power and distinctness, and working perfectly under all conditions of wind and weather. All vibrations above the pitch of upper "G" of the musical scale are in this instrument entirely absorbed, so that whistling sounds, as of wind and the higher notes and vibrations of running machinery, etc., are not heard, although the sensitiveness of the instrument to lower tones remains unimpaired. It seems almost beyond belief that, although one may whisper over a line three-quarters of a mile in length or more, no sound other than that transmitted is heard, even when the wind is so violent that the line wire may be seen swaying and trembling from its power. It follows that no sounds of high pitch can be transmitted at all, whistling being entirely lost, although the rushing sound of the air passing the lips of the whistler can be plainly heard at the distant end. Perhaps it may not have been known before that the sound of whistling is a composite tone, the rushing sound not having been heretofore apparent, through the greater power and shrillness of the musical notes. Whether the acoustic telephone may still be subject to greater development remains to be seen, but that it is now equal to electrical apparatus for lines over a mile in length may be made apparent to any observer. The power of the instrument over half mile lines is so great that it is heard and understood 50 feet distant from the receiving telephone.

I might add that if it were possible to construct a line supported only at the nodes of vibration, as in Fig. 2, I see no reason why the same should not work for many miles. Built in this manner a line would present the following outline, although exaggerated for purposes of illustration, the supports *N N N* in the accompanying diagram being placed at the exact nodes or stationary points, being located upon any line under tension at one-half, one-fourth, one-eighth, etc., of the total length of the wire. It will be seen then that, should the supports be located indiscriminately along the line as at *A*, *B*, *C*, *D*, which occurs in ordinary work, the vibration is seriously checked whenever the fixed supports are between the natural nodes of the line, and the power of transmission will be diminished in proportion to the number of interferences of this kind. This explains why long lines sometimes work louder and give better articulation than shorter ones of no greater angularity. This trouble is largely obviated in the design of a hanger which will vibrate with the line when the point of support is located between the nodes.

The theory of a molecular vibration taking place upon acoustic lines, in addition to what may be termed the apparent or lateral bodily vibration, is illustrated in the multiplex telephone described, the molecular vibration being amplified by the expanding of the resonant surface of the receiving parabolic reflector. The action is the same as that observed in the experiment of scratching a log of wood with a pin, the sound of the pin not being noticeable until the ear is pressed against the log, when it is clearly heard at the opposite end.

A New Insulating Compound.

A new insulating material, described in the *Chronique Industrielle*, has just been produced. It is composed of one part Greek pitch and two parts burnt plaster, by weight, the latter being pure gypsum, raised to a high temperature, and plunged in water. This mixture, when hot, is a homogeneous, viscous paste, and can be applied with a brush, or cast in moulds. It is amber-colored, and possesses the insulating properties of ebonite, and can be turned and polished. Its advantage is its endurance of great heat and moisture without injuring its insulating properties.

A New Alternating Current Dynamo.

The Anglo-American Brush Electric Light Corporation has recently brought out a new alternating current dynamo in connection with their transformer system which possesses some decided novelties. The new machine, which has been designed by Mr. Wm. Mordey, has an output of 35,000 to 40,000 watts at a potential of 2,000 volts, and a speed of 650 revolutions per minute.

In the accompanying engravings, for which we are indebted to the London *Electrician*, Fig. 1 shows the machine complete, and Fig. 2 the armature, which is stationary, and consists of a number of coils of narrow copper ribbon, wound on cores of non-conducting material. Each coil is bolted between two brackets, the ends of the conductors being brought out through porcelain insulators. The brackets are then bolted to a gun-metal supporting ring, being placed outside of the magnetic field so as to avoid loss from eddy currents, which are still further reduced by the employment of German silver for the brackets and bolts.

The gun-metal supporting ring, which is bolted to the bed-plate of the machine, is in two portions, being divided in a vertical diametrical line. These two parts, after having received the coils, are bolted together and to the bed-plate, the field magnet being first placed in position. This design provides ample facilities for repairs, as it allows not only of single coils of the armature being quickly removed and replaced, but also renders it easy to take out one-half or the whole of the armature.

The field magnet, shown in Fig. 3, consists of a single electro-magnet, built up as follows: A short cylinder of iron, through the axis of which the shaft passes, forms the core of the magnet, and round this core is wound the exciting coil. Against each end of this cylinder is placed a cast-iron piece, of a form which will be best understood from Fig. 3. Each casting has a number of horns or arms —nine in the machine illustrated—which radiate from the shaft and central part of the casting, and then bend over,

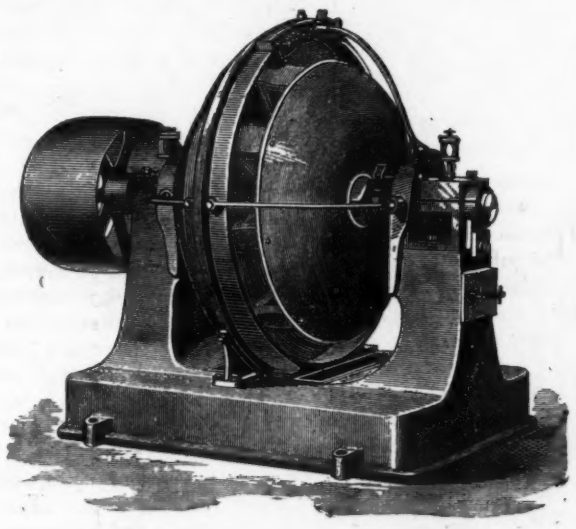


FIG. 1.—MORDEY ALTERNATING DYNAMO.

forming nine pole-pieces on each side of the armature. These horns on one side, as will be seen, approach within a very short distance of those on the other side of the armature, and in this very narrow polar gap or slit the armature is held, the entire field magnet revolving with the shaft on which it is mounted. The ends of the exciting coil are connected to "collector" rings on the shaft, which are shown to the right of the illustration. It will be observed that this form of field magnet is very simple. A single exciting coil suffices for a machine of any size, speed, or number of alternations. Besides its peculiarity of form it differs from the usual arrangements in that it has poles of one size only on each side of the armature; thus the magnetic leakage between adjacent poles on each side is absolutely *nil*.

By revolving the field magnet, instead of the more delicate armature, safety and steadiness of running are secured, the heavy magnet acting as an excellent fly-wheel, and effectually neutralizing any pulsation due to irregularity in the stroke of the engine.

The machine is very nearly self-regulating in itself, as is shown by Fig. 4, which is the characteristic of the machine throughout a range of 37,000 watts. From this curve it is clear that, practically, the whole of the load—or say 600 lamps—might safely be turned off without danger to any remaining lamps, and that a large proportion of the load—certainly 50 per cent.—could be turned off without attracting notice on the rest of the circuit. It is, therefore, not considered necessary or desirable, except under special circumstances, to provide other than a simple hand-regulation at the dynamo for the purpose of controlling the potential difference.

By the arrangement of the armature coils it is easy to obtain various combinations if desired. This circumstance is made use of for simplifying the measurement of the potential. Instead of taking the reading across the terminals, which would necessitate the use of an electrometer, or a very high resistance voltmeter, an ordinary voltmeter, indicating to 100 or 150 volts, is placed across one of the coils, the machine being fitted with a special pair of voltmeter terminals for this purpose. The indication thus obtained, multiplied by the total number of armature coils, gives the potential difference between the armature terminals. The voltmeter may, if desired, have its dial marked to directly indicate the total potential difference.

It is said that this dynamo of 50 to 60 horse-power—the first of its type—was built directly from the first design, without recourse to any preliminary experiments.

The Discussion on the Quadruplex.

To the Editor of The Electrical World:

SIR: Time will not permit me to enter into an extended review of the remarks of Mr. F. W. Jones, the well-known

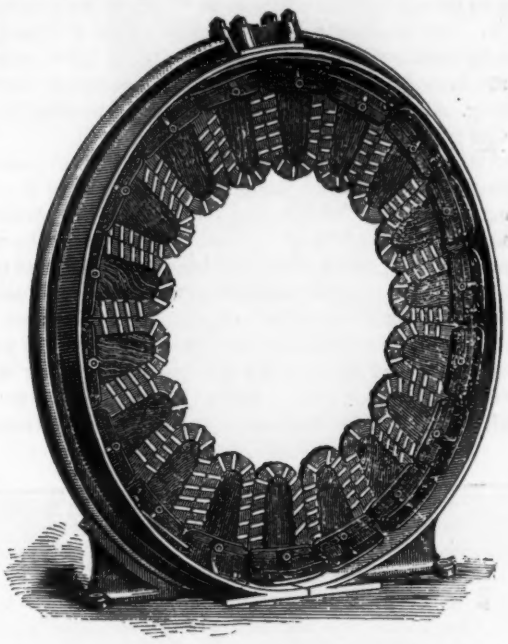


FIG. 2.—ARMATURE OF ALTERNATING MACHINE.

inventor and electrician, upon my recent unpretentious article on "Improvements in the Quadruplex."

It must have been obvious to the general reader of the article that I made no effort to describe the various devices in the order of their invention. The manner in which the different methods were classified was evidence of that, I think. Neither did I set out with a preconceived idea of naming the inventor of every device I might describe.

It may be observed also that I did not and do not now express an opinion as to the merits of the respective inventors, Edison and Nicholson. It was "in that view of the case," namely, the action of the U. S. Patent Office in granting patents at different times and for separate parts of a quadruplex system, to both men, that I said it seemed fair that Nicholson should have at least a share of the title of so important an invention. If the "scrutiny of a court," etc., should righteously determine that one or other of the gentlemen was the prior inventor, that would be another matter.

As Mr. Jones is evidently intent on being historically and chronologically correct, which in the aforesaid article I made no attempt to be, the purpose of the article not requiring it, he will probably thank me for mentioning that the patents to which I had especial reference as "somewhat broadly covering the transmitting apparatus of the quadruplex system," were filed Oct. 14, 1874, and

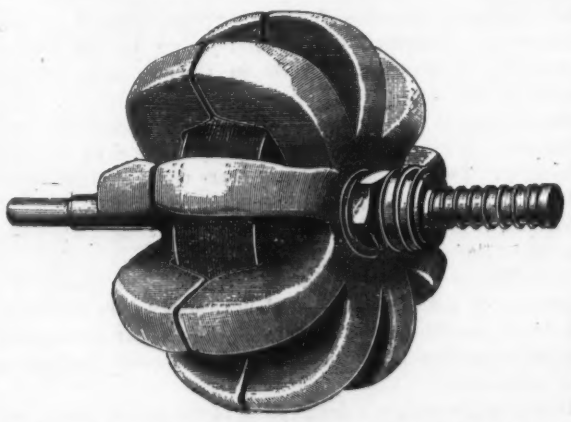


FIG. 3.—FIELD MAGNET OF ALTERNATING MACHINE.

May 11, 1876, which patents Mr. Jones ignores inadvertently.

In referring to Fig. 6, I said that the authorship of that device was claimed by several and was not yet decided. That was an error occasioned by confounding that device with another one in which an induction coil is used in a static compensating arrangement, which latter is in interference in the patent office. Fig. 6 should, I think, be entitled the "Jones Induction Coil Bug Trap," since Mr. Jones has the only patent covering it, even should others claim to have anticipated him in the invention. I am obliged to Mr. Jones for having called attention to the fact that a patent for the device had been granted to him.

I believe I was right in saying that the compound polarized relay is "one effectual means of obviating this particular trouble," since when that relay is employed that trouble, as I had defined it, does not exist. A description of the relay was brought in quite incidentally and, as "already intimated" I did not consider it necessary to name the deviser of every device described. As, however, Mr. Jones' comment might cause it to be inferred that the credit of this invention was withheld from Mr. Edison advisedly, I would simply say that such an inference would be utterly at variance with my intention.

Mr. Jones also gives the impression that I had classed Messrs. Edison and Nicholson as "partners" in the invention of the quadruplex. I referred to them as "competitors."

As regards the utility of the compound relay, it is the decided opinion of a number of capable people that in the hands of expert attendants that relay is probably the best form of No. 2 relay that can be used. What Mr. Jones further states should have been said in this relation in that article, is not what I desired to say at that particular time. It was not necessary for my purpose. At some future time perhaps, if some one should determine on writing a minutely detailed history of the growth of the quadruplex, such precise historical remarks might be expected.

I should, of course, regret by anything I may have said to detract from the just value or prestige of the Jones condenser arrangement, or any other arrangement, and in stating, as I did, that while beneficial on some circuits it was not a decided improvement, I had reference to my own experience with it between 1880 and 1886. That experience, corroborated by the experience of others, is that the improvement in the operation of the quadruplex by its use was so little that its presence or absence in many circuits went unnoticed. At the dates I have mentioned, however, the general efficiency of the quadruplex had been largely increased, and I can readily imagine that with a working efficiency of perhaps 40 or 60 per cent. an improvement of even 2, 3 or 4 per cent. would be more noticeable than when the efficiency had reached say 70 or 80 per cent.

This brings me, I think, to the question of the theory of operation of the Jones and the Smith condenser arrangements, and the function of the coils of the relay in the former, and the resistance coils in the latter, in effecting a

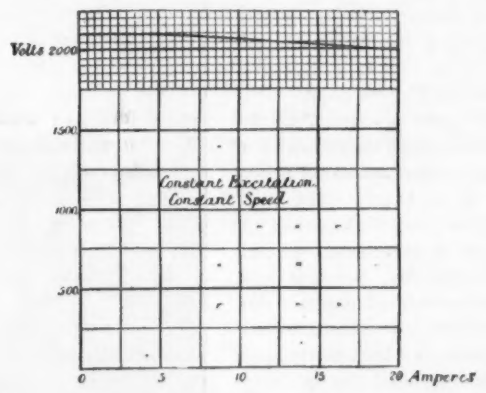


FIG. 4.—CHARACTERISTIC OF MORDEY ALTERNATOR.

difference of potential in the plates of the condenser. Respecting this function, I fail to see anything in the specifications quoted or in Mr. Jones' arugments contrary to my statement that the difference of potential between the plates is produced by the presence of the coils of the relay in one case, and the resistance coils in the other. Remove them, and the opposite plates of the condenser would be at practically equal potentials. At a subsequent time I expect to give my views on this point more at length, in connection with kindred subjects; but in the meantime, I would suggest that Mr. Jones has omitted from his calculations the variations of potential on the main line, due to the co-operation and opposition of the distant battery with and to the home battery. Concerning the question whether the discharging currents of the condenser tend to rapidly reverse the magnetic polarity of the neutral relay, or to prolong the existing polarity, I shall also have more to say, and possibly I may accept the latter view, but in either case, the effect is to diminish the moment of "no magnetism" in the core—not to prevent a reversal of the polarity at all, as could be inferred is the case from a reading of the specifications quoted; and that was the point I wished to make prominent in comparing these methods with those in which the extra magnet and extended armature were used.

I would add that it was not part of my intention to demonstrate that any one method of bridging over or preventing ill effects of the "distant" reversals in the quadruplex was better than another. I think there is still room for improvement, and if in the article alluded to I have shown to those who may be interested, and who were not already familiar with them, the principal methods already devised for that purpose, I have accomplished all that I contemplated.

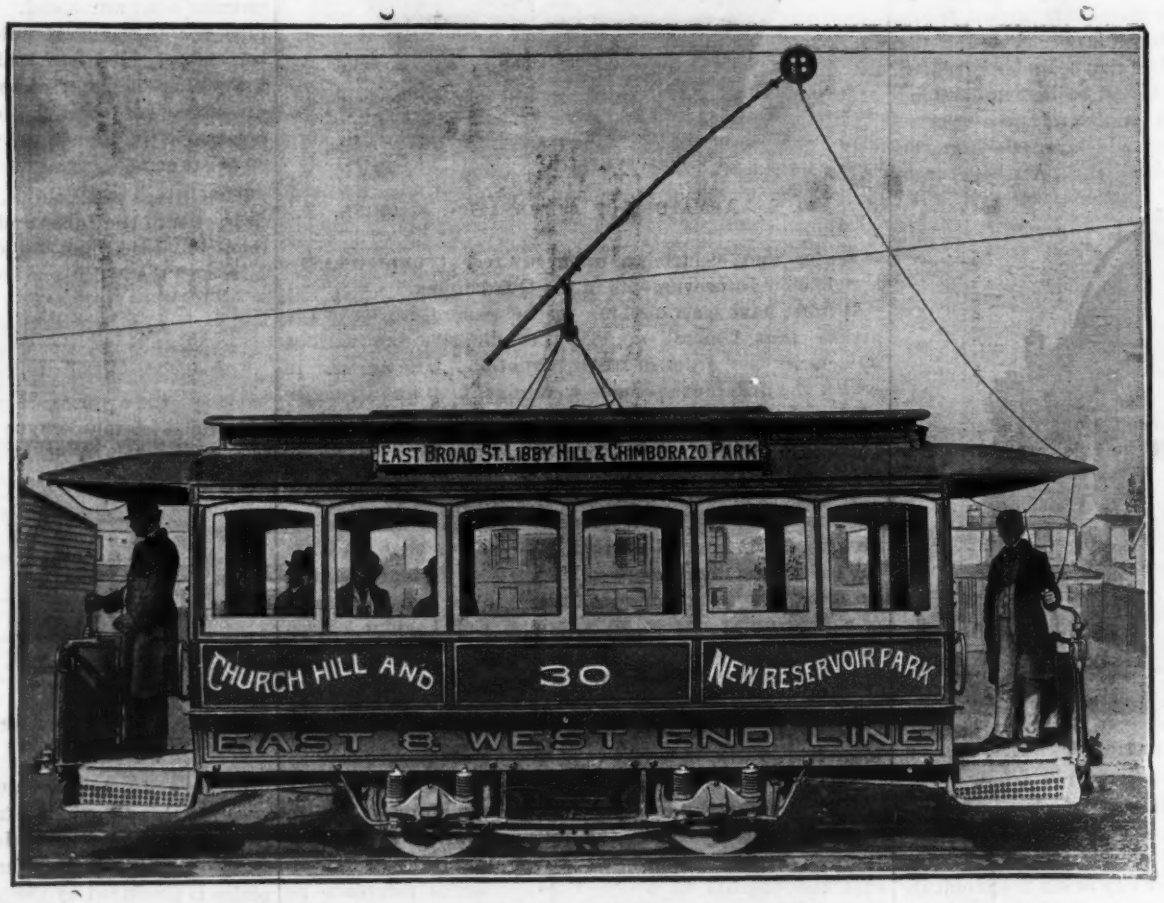
WM. MAVER, JR.

Subway Workmen Indorse Mr. Depew.—The electric subway workmen of this city, who have held together in an informal manner while patiently awaiting the termination of official rows in the Board of Electrical Control and the resumption of the work, have formally organized as a political body to support, it is said, Mr. Depew's nomination for the Presidency. The direct connection of Mr. Depew with the subway is not apparent.

The Sprague Electric Road at Richmond, Va.

We give on this page an illustration of a car on the Sprague electric road at Richmond, Va., the largest enterprise of the kind in the world, and one which has now been for some months in successful operation. The railway is a double track line, operated by the Union Passenger Railway Company, from the extreme eastern to the extreme western limits of the city. The line aggregates 13 miles in length, traversing the city by a very circuitous route, which involves a great many sharp curves and several very heavy grades, ranging up to 10 per cent., while there are no fewer than 29 of the curves that require bent rails, 5 of them being less than 30 feet radius. The cars are electrically of the usual Sprague type, with twin motors, each of 7½ h. p. Each car will carry 40 passengers. The overhead contact is used for obtaining current, by means of a light structure on top of the car. It is a low skeleton framework which carries an adjustable swivelling trunnion, having at its upper end a jaw in which is suspended a counterbalanced trolley pole, having at its extension a grooved wheel making running flexible contact on the under side of the working conductor. On getting at the end of the track this trolley trunnion is swung around so as to trend in a proper direction abaft the centre of the car. It is impossible for it to pull the trolley wire down, and if off the line, it can be replaced quickly and easily. From the trolley the current passes through an insulated wire to two switches, one at each end of the car, whence it goes to the motor circuits, and thence to the wheel frame. The return circuit is through the track, and thence by both metallic and ground circuits to the station. Each section of rail is joined to a copper ground wire, which runs throughout the length of the road underneath or alongside the stringer pieces. At intervals of 500 feet this ground wire is connected to an earth plate, and at seven points, widely distributed, these ground plates are supplemented by heavy iron pipes sunk into iron ore or 12-inch water wells about 25 feet deep. The ground wire is connected to the station, and there is also a main ground connection made there in a thirty foot well through a large sink plate.

It may be mentioned that at Carbondale Mr. Sprague has another overhead contact device, which we have already illustrated, in which the trolley pole is replaced by a very strong coiled spring, at the upper end of which the grooved wheel is placed This admits of free play in every direction, and is working very successfully.



THE SPRAGUE ELECTRIC ROAD AT RICHMOND, VA.

The electric circuit consists of two parts—the overhead and the ground circuits, each being of compound character. Along the curb stones at distances of 125 feet are 30-foot poles inserted into the ground a distance of 5 feet. These poles carry the main circuit, which extends throughout the entire length of the road, and is of copper wire three-sixteenths of an inch in diameter. This is the main conductor. The "working conductor," of the same size as the main conductor, is carried over the centre of the track at a distance of about 18 feet from the ground on insulators supported by span-wires running across from pole to pole, and provided with additional insulators at their ends. The whole structure is very light looking. This working conductor is connected to the main line at intervals of 500 feet by short branch wires. The main conductor is itself supplied at four widely separated points by feeders from the central station.

The motive power plant of this station has been the subject of much favorable comment from all who have witnessed its operation, and many experts in central station work have freely expressed their opinion that its superior, or equal, does not exist among the long list of electric generating stations in the country. The designing of the plant, all plans for its construction and the erection were under the immediate supervision of Mr. J. H. Vail, Consulting Engineer of the Sprague Company. While the usual essential features of high speed power plants have been incorporated in this plant, the designer has gone far beyond these in the way of general appearance and finish, incorporating many features which are very striking and attractive, and also embodying all the modern improvements in detail which go so far toward making a plant not only perfect, but economical.

The specifications for the steam plant were for their respective kinds to be of the very best workmanship and material throughout, and in conformity with that idea the contract was awarded to the Jarvis Engineering Company of Boston for its erection. The boilers comprise a battery of three in number, 6 feet in diameter by 16 feet long, and easily capable of developing 150 h. p. each; the space is also arranged for extension of the battery to admit of four more boilers of the same size. The boilers are set with the Jarvis furnace to utilize as fuel the slack soft coal which is procured in Virginia at low prices; the furnaces are lined throughout with the best fire-brick, which guarantees greater durability of the work. One large iron smoke-stack 80 feet high above grate level, 54 inches diameter at base, and 60 inches diameter at top, furnishes a magnificent natural draught to the boilers, enabling them to be worked fully 20 per cent. above their rated capacity. The engines are of the Armington & Sims type, three in number, of nominal capacity of 125 h. p. each, and are belted to the dynamos direct, dispensing with all shafting. All the machinery is handsomely painted a dark maroon color, and carefully varnished.

The steam connections from boilers to engines, also the exhaust-pipe, are in an underground trench, so that the piping showing in the engine-room is only the polished copper steam pipe, rising to each engine from the main steam pipe in a graceful curve, which, in addition to being a "thing of beauty," is designed to allow the most perfect freedom for expansion and contraction. Between the boilers and engines is placed an approved form of water separator, so that there is no possibility of getting water in the cylinders of the engines. All the piping is thoroughly covered, mineral wool being used in the trenches and magnesia covering for the exposed piping in the boiler-room. Polished brass water-piping in the boiler-room, and the brass guard rails in the engine-room, add much to the attractive appearance of the plant. The water supply is obtained from a well on the premises, and connection is also made with the city service in case of necessity. Two Davidson pumps are used in connection with the National heaters for feeding the boilers; all the water used for the purpose is first passed through a purifying and filtering apparatus.

An efficient automatic damper regulator actuates the dampers of all the boilers, and accurately does its work, while the recording steam gauge in the engine shows that the pressure does not vary 5 pounds between maximum and minimum.

Such, in general, is a description of the steam plant, but it must be seen to appreciate the close attention which has been given to all the details in designing the plant, the object being to guard against every possible contingency which might arise to interfere with its successful operation. The practical working of the plant since starting has shown how well those details have been carried out.

This being the first electric railway plant of any magnitude installed on a comprehensive scale, and complete in all respects, the operating expenses are a subject of much interest. A long experience and accurately gathered statistics have fully demonstrated that the depreciation on dynamos is far less than on any other class of machinery; also that high speed engines have been charged with a higher rate of depreciation than is their due. To this then we may add that the perfection of this steam plant installation adds largely to its economy. The small consumption of fuel and the low cost of other items of operating expenses are a source of much gratification to the directors of the company. A conservative estimate based on actual statistics, gathered from central stations for some years, places the cost of a horse-power per year applied to the car at not more than $35, estimating 720 hours per month.

The dynamos are six in number, all connected in multiple arc, feeding into a "bus" line. One side of the "bus" is connected to the ground, and to the other side are connected the feeders. Each dynamo is of 40,000 watts capacity, and is wound for a potential of 500 volts.

Owing to the character of the soil and lack of pavement the road-bed was found to be a source of much trouble; a good portion of the track being laid in mud and clay streets, which in moist weather unsettle the curves, throws the track out of gauge, and permits the accumulation of more or less soil on the rails. Steep grades of 10 per cent., and sharp curves of 27 feet radius, combined with a 7 per cent. grade, and with the outer rail of the curve nearly 3 inches lower than the inside rail, have been found to be difficulties of no mean importance to overcome.

Before this road was put in operation numerous street car experts did not hesitate to state that the grades and curves were obstacles which could not be successfully overcome, but the spectacle of a car loaded with forty people running up a ten per cent. grade at a high rate of speed, and the wheels giving a remarkably perfect adhesion to the rails, is something that convinces the most skeptical person. All adverse prophecies have failed and the actual demonstration is sufficient to satisfy the most critical street railway man of the entire feasibility of the electric system under any and all conditions of practical every day use.

This road is by far the most important and extensive electric railway enterprise ever undertaken, and has involved more difficulties and a greater variety of obstacles to the successful application of self-propelled cars, as well as to the employment of electricity, than were ever before attempted. Returns for the week ending May 9 showed an average of 20 cars out per day, running 1,548 miles, or nearly eighty miles each, and carrying 7,378 passengers, at a total cost per car for road operating expenses of $1.98, and of $1.48 for station expenses. In other words, the cost of operating, except official and salary charges, taxes and insurance, is only $3.46 per car per day on an 80 mile run, and this is stated by Mr. E. P. Harris, the well-known street car expert, to be only 40 per cent. of the cost of operation by horses with the same number of cars, with the additional advantage that, in point of fact, the road with animal power, for the same work, would require not less than 25 cars, with a stable equipment of from 275 to 300 horses.

The Theory of Diamagnetism.

According to many physicists, Weber and Tyndall amongst others, diamagnetic bodies take, under the influence of magnets, a state of polarity opposite to that which is taken by iron under the same conditions, and this opinion has become classic in teaching. M. Blondlot, however, according to *Cosmos*, has demonstrated that in reality diamagnetic polarity does not exist at all; and that, following the opinion of Becquerel, all substances and the air itself are, in reality, paramagnetic, a diamagnetic substance being only a substance less magnetic than the air. He recalls in the first place, the experiments which led Tyndall to his conclusions. A bar of bismuth, placed on a coil and submitted to the action of a powerful electro-magnet, takes contrary poles to those which a bar of iron takes under the same conditions. The experiments of M. Blondlot show that bismuth becomes magnetic in the same manner as iron, but that the change in its polarity arises from the fact that the medium which surrounded it is more magnetic than itself, when the medium is air. He replaced the bar of bismuth by a tube filled with a weak solution of perchloride of iron in methylated spirits. This tube is magnetic, and becomes magnetic in the same manner as the bar of iron when it is in air, a medium less magnetic than itself. But when it is plunged in a vessel containing a *concentrated* solution of perchloride of iron, a medium more magnetic than itself, it becomes magnetic like the bar of bismuth of Tyndall's experiment.

Improved Hill Clutch Coupling for Electric Light Stations.

Managers of electric lighting stations are rapidly recognizing the benefits of having the machines perfectly independent of each other, though connected to the same line of shafting; and for this reason clutch pulleys and couplings have come into extensive use in many stations. Of this nature is the well-known "Hill" clutch, made by the Hill Clutch Works, of Cleveland, O., a description of which has already appeared in our columns. We would draw attention, however, to recent important improvements in the same, shown in the accompanying illustrations. The Hill clutch has heretofore been made with only two or four arms, the latter being the common form. The improvement consists in making it with six arms. This at first seems a very slight change, but further consideration will show this to be a valuable improvement. Briefly stated, its points of excellence are as follows: A six-arm clutch gives fifty per cent. more power than a four-arm clutch of the same diameter of clutch ring. Secondly, it makes a very compact, rigid and symmetrically proportioned clutch; takes up less space on the shaft, and is of smaller diameter than a four-arm clutch of equal capacity. It makes it possible also to place a clutch of ample capacity on very wide face pulleys of small diameter, and also on gears and hoists of small diameter, which could not be formerly accomplished. Fig. 1 illustrates the six-arm clutch applied to a clutch coupling, making a better proportioned coupling than if a four-arm clutch had been used. Fig. 2 illustrates the same in section, showing the construction.

We understand that the Hill Clutch Works, of Cleveland, Ohio, are now in a position to apply a friction to a pulley of any size that may be required for the transmission of the largest powers.

Balancing Moving Parts.

To the Editor of The Electrical World:

SIR: In your issue of December 17, 1887, in an article by Prof. Sylvanus P. Thompson (on p. 316) occurs the following sentence: "Every engineer, worthy of the name knows that a thing so balanced as to stand in any position is not necessarily balanced for running; that a four-pound weight at three inches from the axis of rotation, though balanced statically by a one-pound weight at twelve inches from the axis, is not balanced by it dynamically: for the moments of inertia about the axis are not equal. On the contrary, a four-pound weight at five inches is balanced by a one-pound weight at ten inches from the axis."

It is often difficult to find the springs which prompt to controversy. Perhaps we are not answerable for the motives. When a man stumbles physically we help him up. If he stumbles mentally we are barbarously apt to goad him. And why? Because it sometimes affords us amusement to indulge in the psychological exercise of tracing, or of endeavoring to trace, the paths by which the human mind gets astray in a labyrinth of error. But it is hardly worth the while. That Prof. Thompson is in that position is obvious to any man or boy who has experimented an hour with lever and weights and has reasoned on their functions. He needs no other apparatus than these simple elements to show all there is of the law of virtual velocities, all that exists of the ties by which the busy universe is kept in equilibrium, and all that is needed as a compass to lead him back into proved and well charted fields.

A rotating body, balanced "dynamically," is balanced statically. There are machines for practically proving this in nearly every principal town in America. And some of those machines are proving, a hundred times a day, that a rotating body balanced at one rate of speed is balanced for all rates of speed.

What there may be of an intermittent character in the shape of electrical resistances in a dynamo, as to

THE SAMSON BATTERY.

produce troublesome jars while running, is not now brought into question. The vibrations or jarring caused by the unbalanced rotating parts of machinery are owing, not to the centrifugal force of excessively heavy portions, but to a striving, as of all rotating bodies, to assume rotations upon their centres of gravity. If it be desired that a rotating body run smoothly without jarring its adjuncts, its qualities must be the same as those of a body rotating in space, having a mechanical centre upon which it is desired it shall rotate and a mechanical plane in which it is desired it shall continue. Now this is not difficult to understand, and it is so fortified by mathematics and by mechanical experiment as to be impregnable.

"A thing so balanced as to stand in any position is not necessarily balanced for running," says Prof. Thompson. It is only by running that the centre of gravity of any mass can be mechanically found. There must be a *running* in some degree; if not that of complete rotation, it must be that of complete oscillations in arcs of circles like those of scale beams and levers. When by such means the centre of gravity of a mass be found, and the mass be poised thereupon, it can be rotated in any plane and at any degree of velocity, and cause no more disturbance to its supports than when standing still. This has been proved in practice during every working hour for years, and is so axiomatic as to seem tame. Yet it proves that "a 4-pound weight at 3 inches from the axis" and "a 1-pound weight at 12 inches from the axis" *have* equal moments of inertia, and balance each other under all conditions of rest or revolution.

CHARLES SEYMOUR.

DEFIANCE, O.

The Samson Primary Battery.

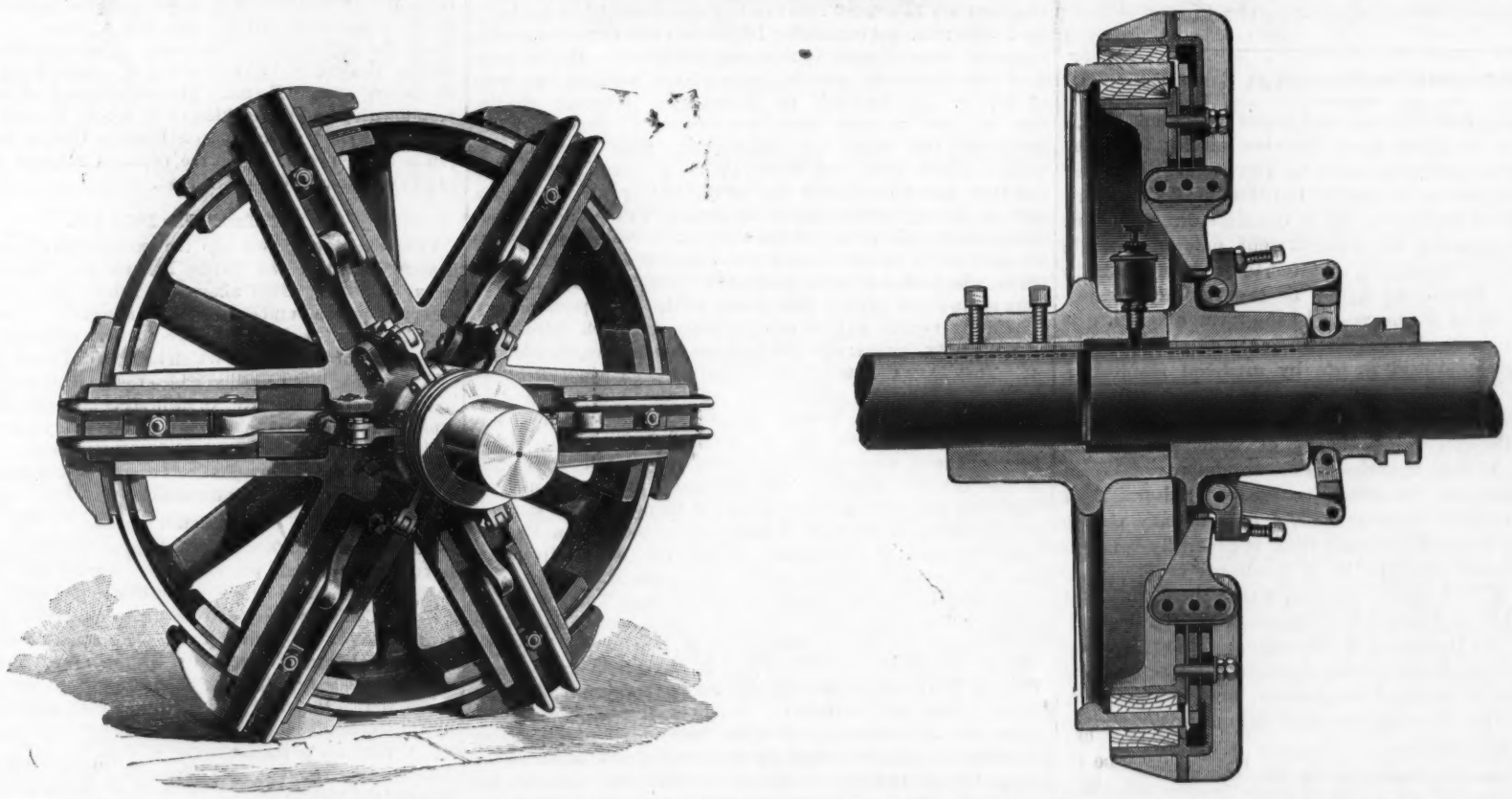
We illustrate on this page the Samson battery for open circuit work, recently brought out by the Electric Gas Lighting Company of Boston, which has the exclusive control in America, and the tests of which show some remarkable results. One leading feature of the battery is the carbon, made up in the form of a corrugated vase, giving an unusually large surface. This is almost entirely inclosed by the zinc in the form of a thin sheet, to which a terminal like the ordinary zinc rod is attached. Contact between carbon and zinc is prevented by little earthenware buttons set in the carbon, and the whole is inclosed in a glass jar of the familiar shape. A solution of sal ammoniac is used as the electrolyte, and as soon as set up the battery gives out its current for work. The top of the battery is protected by a rubber cover fitting snugly around the teeth or flutings of the carbon cup. This battery has been in use, we are informed, for two years, on the French Government telegraphs, with excellent results. We give below a report from Prof. A. E. Dolbear, of Tufts College, on the battery:

TUFTS COLLEGE, May 15, 1888.

Report on the performance of four cells, examined for their E M. F., Internal Resistance and Current Strength.

Name of cell.	E. M. F.	Int. R.	C. at outset.	C. after 30 min.
Genuine Disque Lec. (Gonda)..	1.46 volts	1.25 ohms	.61 ampère	.26 ampère
"E. G. L." Disque Lec....	1.52 "	1.30 "	.63 "	.37 "
Samson No. 1 ...	1.44 "	.14 "	1.16 "	.52 "
Samson No. 2....	1.47 "	.11 "	1.11 "	.70 "

The cells were all put in circuit with a resistance of 1.1 ohms, and kept on that circuit for the above measure of current. The very small internal resistance of the two "Samsons" enables them to give a current very nearly twice as great at the beginning as either of the others, while the "Samson" No. 2 gave a stronger current (.70 ampère) after half an hour's short circuit than either of the Disque Leclanché cells at the beginning. It should be remarked here that the Samson No. 1 was a smaller cell than the No. 2, and, of course, would not be expected to give the current of the large one. Chloride of ammonium batteries have this advantage over most other cells, that after working and a partial exhaustion they will recover their original power if left unused for a time. The length of time needed to fully recover depends upon the draught made upon them, but when the period of use is short, as in bell ringing, gas lighting, etc., there is always ample time for full recovery. It appears, therefore, that the Samson cells are much more energetic than the ones they were compared with; so much so, that one of them is about as good as two of the latter kind for such service as the production of strong currents or strong magnetic effects. The device of making the carbon cylindrical and fluted enables them to contain a large quantity of the binoxide of manganese, and presents a large surface to the solution. The shape of the zinc and its proximity to the carbon is another advantage for such work. I have also tested the cells for telephone work, and find them very superior. Their small internal resistance enables them to give a stronger current through the induction coil than any Leclanché cell I have ever tested before. This amounts to 25 or 30 per cent. The cell meets my commendation.



FIGS. 1 AND 2.—IMPROVED FORM OF HILL CLUTCH COUPLING FOR ELECTRIC LIGHT STATIONS.

Cloud Telegraphy.

A remarkable experiment in signaling with electric lights was recently made by the officers of two vessels of the British Navy, the "Orion" and the "Espoir," off the port of Singapore. The "Espoir" had sailed from that port for Hong Kong, leaving the "Orion" in the harbor of Singapore. When the "Espoir" was 60 miles distant, the "Orion" sent her a message by throwing a brilliant light upon the clouds, and the reflection of this was seen distinctly by those on board the "Espoir," and by this means a regular message of alternate long and short flashes was read and understood by the "Espoir." The practical use of cloud telegraphy as a recognized means of communication would probably be confined to special circumstances, and would, of course, depend upon the state of the weather, but the possibility of communicating a distance of 60 miles at night without wire is very im portant. The first application of such a means of telegraphing which suggests itself is that of lighthouses, whose lights could be rendered visible to a much greater distance on cloudy nights if provided with an apparatus for flashing on the clouds. The reflections often seen at night from the blast furnaces in some of the large manufacturing towns are visible to a great distance, and give some idea of the effect of the electric light upon the clouds.

Another Electric Alarm Clock Arrangement.

BY H. E. H.

In THE ELECTRICAL WORLD of recent dates I have seen descriptions of a simple alarm. The following is a description of an attachment which I have put on a common Ansonia alarm clock. On the iron frame to which the face is fastened there is clamped a flat German silver spring between two pieces of hard rubber. In the works I have removed all the alarm mechanism except the gears which set it off. The hub of one of these gears is formed into a cam, so that when the gear has turned around once, the spring which holds the alarm drops, liberating the hammer. Now, setting the German silver spring directly under the second spring, when it drops, instead of liberating the hammer it closes an electric circuit with the German silver spring. By referring to one of these clocks it will be noted that the time at which the bell will commence to ring may be varied by the regular alarm set. One wire is led insulated into the inside of the case and attached to the German silver spring; the other to any part of the clock most convenient. It will be necessary to use a switch for the same reasons as in the other descriptions referred to.

M. D'Arsonval on Dangerous Currents.

The following is an abstract of a paper presented by M. D'Arsonval to the Academy of Sciences relating to experiments with various generators of electricity. He used (1) a Holtz machine to charge a Leyden jar; (2) a battery with E. M. F. of 420 volts; (3) a Gramme direct-current machine; (4) Gramme alternate-current machine; and (5) induction coils. Electricity is stated to produce death in two ways—(*a*) directly by injury to the tissues; (*b*) indirectly by action on the nerves. In the former case life is beyond recall; in the latter, it is in most cases possible to bring the individual back to life by artificial respiration instantly resorted to. A static discharge is not absolutely mortal, unless the "medulla oblongata" be struck by a localized discharge, the energy of which exceeds 22 foot-pounds. In that case the tissues are destroyed. With weaker discharges, the effect is due to excitement of the nervous centres, or, more tardily, to secondary results of injury. It is much less easy than is generally believed to kill an animal outright by a discharge of frictional electricity. M. D'Arsonval concludes that the duration of discharge is of the greatest importance; and, in alternating currents, the frequency of alternation. In the general case of accident, death occurs through reflex action, and mostly through arrested respiration; and the practical conclusion is that in every case artificial respiration should be instantly resorted to.

"The Origin of Energy."—Cupples & Hurd, of Boston, are publishing Volume 1 of a new work by Leonidas Le Cenci Hamilton, on a new hypothesis as to electrical and other phenomena, the idea being that "all matter tends to rotation." The book is called, "The Origin of Energy: Electrostatics and Magnetism."

Electrical Executions.—Governor Hill has signed the bill abolishing hanging in New York State for all murders committed after June 1, 1889, and substituting as punishment death by electricity. The steps which have led to this, since the Governor first called attention to the subject in a message to the Legislature in 1885, are well known.

"World English" is the title of a striking little work, written by A. M. Bell, and published by N. D. C. Hodges, *Science* office, 47 Lafayette Place, this city. It is nothing less than a scheme of phonetic English, worked out with much patience and logical ingenuity, and having for it not a few recommendations to scientific minds. The hugeness of the reform is the chief obstacle to its introduction, but that efforts of this kind are constantly renewed gives promise of ultimate success; and when the change comes it will certainly take some such shape as this, rather than Volapuk. Mr. Bell's pamphlet should find many readers and students.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, June 11, 1888.

The American Company.

At the directors' meeting Wednesday, June 6, of the American Electric Manufacturing Company at its offices, 3 East Fourteenth street, New York, new officers were elected in the places of Mr. H. C. Adams, president and Mr. F. E. Allen, secretary and treasurer. The new officers are A. R. Brown, president, and F. N. Sowden, secretary and treasurer, both of the city of Boston, Mass. A stockholders' meeting is called for the 19th of June.

The Giles Anti-Magnetic Shield.

Mr. Addison Conkling, who is well known to a great many of your readers, has been appointed Eastern agent for the Giles anti-magnetic watch shield, and has established his headquarters at 1½ Maiden Lane.

What the Hangmen Think.

The following will be of interest in regard to the new execution law: "Joe Atkinson, known as 'Isaacs the Hangman,' of Williamsburg, strongly expressed himself to an inquiring reporter on the Electrical Execution bill. 'What do I think of the bill?' said the hangman. 'Well, while I am in favor of the easiest and most convenient form of death, I am convinced that electricity as a punishment in capital cases will be a failure. Why the very thought of such an easy death and the absence of the gallows will strike as little terror in murderers' hearts as a six months' term in Sing Sing. I tell you there was no better determent to crime than the gallows. Hanging too, under my supervision, was painless and effectual, as was shown recently in the case of Danny Driscoll, the Whyo chief."

Leather Link Belting for Dynamos.

Chas. A. Schieren & Co., report recent sales of their leather link belting to the following electric light plants for use on dynamos: Florence Electric Light plant, Florence, Ala.: Scranton Illuminating, Heat and Power Company, Scranton, Pa.; Thomson-Houston Electric Company, Lynn, Mass.; Narragansett Electric Light Company, Providence, R. I.; Sheffield Electric Light Works, Sheffield, Ala.; Citizen's Electric Illuminating Company, Brooklyn, N. Y.; Thomson-Houston Electric Company, Orange, Mass.; J. J. Robbins, Scranton, Pa.; Hempstead Gas Light Company, Hempstead, L. I.; Jenney Electric Light and Power Company, Logansport, Ind.; Chelsea Gas Light Company, Chelsea, Mass.

The Roberts-Brevoort Electric Company.

At the offices of the above company, 237 Fifth avenue, New York, on Friday evening, June 8, was given the first public exhibition of their primary battery system of generating electricity for light, power and heating. They have the main floor and basement devoted to the various departments of the system. In the basement are 14 wooden cells two feet square and 16 inches high, lined with zinc, and containing 16 porous cups of the company's improved patented style, 16 zincs and 32 carbons. On the main floor were distributed some 20 lamps of low voltage; two were of 32 c. p., inclosed in McCreary's reflector shades, one in the window and one over a drawing room table in the rear, for illustrating their use in the home. There were also three 16 c. p. lamps inclosed in reflector shades of smaller size for illustrating the use of the light in library sitting and dining rooms. Two were also put each side of the large one in the window, throwing rays out into the middle of Fifth avenue and attracting the attention of pedestrians, who flocked in upon invitation. Eighteen 16 c. p. lamps were set in small ground glass shades of the tulip pattern very tastefully arranged as table or drop lamps, of which there were several pretty designs; also side brackets and fixtures, chandeliers, etc. They have the main floor divided off in compartments to show the various applications of the light. In the upper right hand corner of the front window was a Backus exhaust fan, run by a C. & C. motor, ⅛ h. p. They will have, when completed, every conceivable application of the battery power. The following prominent men in New York City have used and are using to day plants installed by this company: Mr. E. H. Johnson, president Edison Electric Light Company, at his residence in New York City. He had a plant of 14 cells, eight 16 c. p. glow lamps, put in last spring, and it was used up to about June 2, or in all 90 days. There were 532 pounds of zinc put in the 14 cells, and when taken out June 7 the zincs weighed 252 pounds, 280 pounds of zinc having been consumed. The plant of 8 lights is said to have been used freely.

Mr. E. N. Dickerson, the well-known lawyer, has a four-light 16 c. p. plant and thinks very highly of it. Mr. Theodore B. Starr, the Fifth avenue jeweler, has had two cells of this battery for 90 days, and had used it up to June 7, 1,134 hours, during which time there was three changes of solution and one renewal of zincs on June 7. The company will rent the plants or batteries and take care of them at exceptionally low rates, or dispose of them on reasonable terms. The Fifth avenue exhibition and salesrooms are under the supervision of Col. S. B. Lawrence.

Round Chain Belting.

The Solid Link Chain Manufacturing Company, of 51 John and 2 Dutch streets, are making a very substantial combination round chain belt to take the place of round leather belt. It is made of brass and copper. I understand it is being used very successfully on electric motors for small power, and the application is demonstrated on a Silsby electric pump and a C. & C. motor in the window of the Silsby pump agency on the main floor of 51 John street.

Personal.

Mr. R. T. McDonald, general manager of the Fort Wayne Jenney Electric Light Company, was in Chicago last week, I hear. Mr. McDonald reported business booming in both the arc and incandescent departments of his company. The Fort Wayne Jenney Electric Light Company are putting in a 300 h. p. Corliss engine at their Fort Wayne factory for testing purposes. One thousand incandescent lights are being turned out per day. The plant of their system at New Orleans is being increased with 10,000 incandescent lights of the alternating system. The company have just been awarded the contract for lighting the city of Saratoga with arc lights.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
48 Congress Street, Boston, June 11, 1888.

Personals.

Mr. W. Adams, of the firm of T. F. Hunter & Co., electric light contractors and dealers in general electrical supplies, 37 Church street, New York, has established a branch office at No. 65 Oliver street, this city. Mr. Adams will devote considerable of his time to the sale of the Eddy electric motor.

Mr. T. B. Doolittle, of Bridgeport, Conn., was among the new members recently elected to the Boston Electric Club.

Mr. C. J. Field, chief engineer of the Edison United Manufacturing Company of New York, was married recently to Miss Craven, of Brooklyn, N. Y. The happy couple, while on their bridal tour, passed a few days in Boston. Mr. Field is being warmly congratulated by his many friends.

Mr. Albert H. Chapman, widely and popularly known in electrical circles, has, I regret to learn, resigned from the position he has creditably filled for so long a time as superintendent of private lines of the New England Telephone and Telegraph Company.

Dr. Robert Amory, who has been identified with several electrical enterprises, has been appointed manager of the Boston office of the New England Telephone and Telegraph Company. His predecessor, Mr. C. A. Perkins, has taken a more active position with the same company as engineer and superintendent of construction.

Mr. John B. Bennett, of Indianapolis, Ind., the well-known inventor, has associated himself with the Lord Acoustic Manufacturing Telephone Company, of Boston. Some of Mr. Bennett's valuable patents are now the property of the company named, and will largely contribute to the popularity and success of the Lord acoustic telephone.

Boston Electric Club.

This wideawake and progressive organization is constantly manifesting new evidence of its steadily increasing prosperity, which augurs well for its permanency and prominence. At the regular monthly meeting of this club at its rooms, on Monday evening, June 4, twenty-three new members were elected, seventeen of whom became active members and the remainder associate members. Among the important matters discussed was the proposed anniversary of the club, which will occur on Thursday, June 21. The committee of arrangements reported having agreed upon the following programme for the entertainment of the invited guests: "At 2:30 o'clock in the afternoon a lunch will be served at the club rooms, which will be followed by the reading of papers on scientific subjects and subsequent discussions, together with social talk. At 4:30 o'clock the members and invited guests will be conveyed to a steamer at India Wharf, and will enjoy a sail down the harbor to Nantasket Beach, when, upon arrival, they will proceed to the Rockland Hotel, and will partake of banquet. Afterward riding or bathing will be indulged in, and at 9 o'clock a special train will convey the excursionists to Boston. The committee of arrangements has been untiring and painstaking in its labors toward making the first anniversary of the Boston Electric Club a success, and it can be safely predicted that the occasion referred to will be an enjoyable one to every participant.

"Clark" Wire Defies Fire.

I visited a day or two ago the recent scene of conflagration at Station No. 2 of the Edison Electric and Illuminating Company, in Boston. High above the ruins of the dynamo room I observed quite a number of cables suspended from the charred and blackened walls. Strange to say, although these cables had been through a fire which had burned away all the rafters and sheathing that had surrounded them on all sides, their insulation was scarcely injured. In little spots here and there, probably where a cable had rested across a rafter or a joist, the insulation had been burnt off, yet the covering on the cables did not ignite. This proves beyond a doubt that covered wire slicked with Clark's Patent Compound is not inflammable.

The Mather System.

The Woman's Reformatory Prison, at Sherborne, Mass., is to have an electric light plant, and the contract has been awarded to Messrs. Claflin & Kimball, New England agents for the Mather Electric Company, for 320 incandescent lights, and they will begin work on the plant at once. This makes the second State institution lighted by electricity, the other being the State Almshouse, Tewksbury, Mass., of 500 lights, which was also awarded to the Mather Co., and has given perfect satisfaction from the day of starting, being highly spoken of by those connected with it. In addition to the above the new steam yacht of Mr. Geo. Fabyan, being built at East Boston, will be lighted by a 50-light plant of the Mather system.

Newly Elected Officers.

The present officers of the Narragansett Electric Lighting Company, of Providence, R. I., are, viz., Harvey E. Wellman, president; Marsden J. Perry, vice-president and general manager; D. A. Peirce, treasurer, and Van A. Thomas, superintendent and electrician.

The Wainright Factory.

A recent visit to the lovely town of Medford, Mass., enabled me to make a friendly call upon general manager C. D. Wainwright, of the Wainwright Manufacturing Company, whose private office is and will hereafter be at his company's factory instead of at the salesrooms on Oliver street, Boston. Mr. Wainwright's office, together with counting-room, superintendent's office, drafting-room, etc., etc., occupy a neatly furnished two-story building adjacent to the main factory. The office faces the roadway, through which the visitor will have to pass to reach the various factory buildings. The main building is four stories in height, and its dimensions are 80 by 35 feet. It is equipped with the latest style of improved machinery for making the feed-water heaters, corrugated tubing, expansion joints, condensers, filters and radiators. There are a half dozen smaller buildings adjoining the principal factory

These are used separately, each for a special purpose; a foundry, where all the castings are made; a carpenter (or model-making) shop; blacksmith shop; machine shop; testing room and store-room, and one for general use. The manufacturing facilities of the Wainwright Company are being increased from month to month, to keep pace with the growing demand for their specialties. The officers of the company are as follows: Jere Abbott, president; John A. Loring, vice-president; Percival L. Everett, treasurer; C. D. Wainwright, general manager; J. M. Betton, secretary.

Thomson-Houston Plants.

The Thomson-Houston Company report the following new plants: Frederick, Mo., 60 arcs; Madison, Wis., 30 arcs; Revere, Mass., 150 arcs and 500 incandescent; Reedsville, N. C., 50 arcs; Owego, N. Y., 35 arcs; Waterville, Me., 500 incandescent; Medford, Mass., 500 incandescent; Potsdam, N. Y., 500 incandescent; Hyde Park, Mass., 50 arcs. Also the following increases: Houghton, Mich., 30 arcs; Mankato, Minn., 30 arcs; Jacksonville, Ill., 30 arcs; Canton, Ill., 30 arcs; Crawfordsville, Ill., 70 arcs; Des Moines, Ia., 70 arcs; Cambridge, Mass., 100 arcs; Salem, Mass., 400 incandescent.

Burying Magnetized Watches.

Among many fine watches apparently spoiled by too close contact with electric motors was one owned by Dr. W. H. Pulford, Jr., a homœopathic physician, writes a New York *Sun* correspondent from Ansonia, Conn. He tried to devise some way of remedying the difficulty without going to a heavy expense, and, recollecting the diffusive qualities of the ground in electricity, he hit upon a plan. He inclosed his watch in a cloth bag and buried it in a large box of damp earth. Here it remained for three days. Yesterday he dug it up, and after twenty-seven hours' running the watch has not varied a hair, whereas before it would not run at all. The simplicity of this process of demagnetization of watches recommends itself to the owners of damaged watches, while the jewelers who have been reaping a harvest from this source ridicule it. I don't think we shall find many people burying their watches.

Armington & Sims Engines.

Speaking of their engine, Mr. Gardiner C. Sims said last week: "Our first order for an engine to drive an Edison dynamo by belts required but 18 h. p.; steam pressure, 80 pounds. Prof. William D. Marks, constructing engineer Edison Light Company, Philadelphia, has just given us an order for four engines of 440 h. p. capacity each; steam pressure, 150 pounds. Our special double engine that you so kindly mentioned some time ago and which is shown in our advertisement has attracted some attention. We now have orders for five double engines of 100 h. p. each, and five of fifty h. p. each to drive alternating current dynamos."

Relative to Conduits.

At a meeting of the Aldermen on Wednesday last Alderman Gove presented the following orders, which were read once: That the superintendent of streets is hereby authorized and directed to issue a permit to Henry C. Cobb, Royal M. Pulsifer and Francis R. Chapman and their assigns to open certain streets named in the order passed by the Board of Aldermen May 7, 1888, for the purposes therein named, and according to locations marked by green lines on plans filed at the office of the City Clerk, in connection with the acceptance of the grant under said order; also, an order that the plans and systems known as the "drawing-in duct system," with manholes at convenient intervals and "carbonized stone conduits," are hereby approved as the plans, system and material to be used as conduits for carrying electric wires under the streets, until otherwise ordered. Alderman Kelley presented the following order, which was passed, and reconsideration refused: That no more permits be issued for opening streets to construct conduits or lay electric wires without the approval of the Board of Aldermen. All orders inconsistent with this are hereby revoked. A communication was received from Henry E. Cobb, R. M. Pulsifer and others, accepting the underground conduit franchises and locations. The communication was placed on file. The bond of Henry E. Cobb, R. M. Pulsifer and Francis R. Chapman as principals, and of Patrick Meehan and Azariah F. Crowell, as sureties, in the sum of $200,000, was received and referred to the committee on bonds.

An Active Construction Company.

The firm of John Post, Jr., & Co., engineers 70 Kilby street, Boston, have just completed another steam plant for electrical lighting, a class of work they make a specialty of in addition to their business of installing general steam plants. The new installation referred to is at Eastport, Me., and is a plant consisting of the following equipment: A 150 h. p. steel boiler and a 100 h. p. Ide automatic engine, with a full equipment of auxilary apparatus necessary to complete it, furnishing power for one 50 light arc and one 500 incandescent Thomson-Houston machine, with a margin for additional machinery. Messrs. Post & Co. have during the past few months installed electrical steam plants at Hartford, Middletown and New Britain, Conn.; Hyde Park and New Bedford, Mass.; Dexter and Presque Isle, Me., with complete equipment of steam apparatus, all furnished by them. These plants aggregate 1,000 h. p. They have several others in process. The Ide engine, which they are the agents for, has established itself at the front by its economy, close regulation and substantial construction, and is a representative feature of the business practice of this concern, who propose to use only first-class machinery and do first-class work. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., June 9, 1888.

Personal.

Mr. William Doty, a well-known constructing electrician of this city, has purchased the manufacturing establishment of Vallee Brothers, at 727 Filbert street, and intends to turn out all kinds of electrical goods of a high grade. He has secured a thoroughly equipped establishment, and there is little doubt of his success.

Thomson-Houston Plants.

The Philadelphia Cloak and Suit Company have given an order for a fifty-lamp Thomson-Houston machine, which they propose to use to supply quite a number of series incandescent lamps. The firm have a 90 horse-power Ball engine, which was started last week. The plant will be complete in about two weeks. Mr. J. W. Parker has taken an order from Shoneman Brothers, of 116–118 North 8th street, for a 27 horse-power Ball engine, and has contracted to put up the steam plant complete. The Thomson-Houston system will be used in lighting the establishment.

New Glass Works.

Mr. James J. Murray, of the firm of J. J. Murray & Co., of Meriden, Conn., is about to erect a new glass works in this city, for the manufacture of fine glassware, and a specialty will be made of electric light glass of every description. The building, which will cost about $30,000, will be located at Trenton avenue and Westmoreland street, and the most improved machinery will be placed therein. Mr. Murray decided upon this city for the location of his plant because of the superior transportation facilities, and when it is in operation several hundred skilled workmen will find employment. Crude oil will be used as fuel, and about 2,000 gallons will be consumed per month.

Silent Tickers.

The tickers of the Electric Reporting Company suddenly ceased to give New York stock quotations last Monday. The company is a local one, and was organized about five years ago as an auxiliary to the Bankers' and Merchants' Telegraph Company. New York quotations were furnished to it by the Commercial Telegraph Company in New York. Some time ago there was a disagreement between the companies, and the Commercial began a lawsuit, which is still pending. Officers of the local company, which is located at 108 South Third street, say that the difficulty will soon be adjusted and service will be rendered as usual.

The Penn Electric Company.

Councils' Sub-Committee on Law, to which was referred Councilman Scott's resolution of inquiry as to the legality of ordinances granting privileges to the Penn Electric Company, Wednesday listened to the attorney for the company. He held that his company was entitled to lay its conduits because it had complied with the act of 1874, which gives foreign corporations the right to transact business in this State by filing in the office of the Secretary of the Commonwealth a copy of the charter and thereafter paying a tax. It was decided that Mr. Morgan should submit his argument in writing. The Penn Electric, which has done a large amount of underground work, was incorporated in New Jersey.

Telegraph Taxes.

City Solicitor Warwick last week collected and paid into the City Treasury the sum of $11,847.75. This represents the amounts due by the Western Union, Mutual Union, Continental, American Union and the Atlantic & Pacific Telegraph companies for the years 1883 and 1884. The above sum also includes interest and costs. This was an action to recover license fees due to the city of Philadelphia for permits to erect poles and suspend wires during that period. Steps will be taken to recover the amount due from 1884 to the present time.

Fixtures for Tyler, Tex.

Messrs. Horn, Brannen & Forsyth, of this city, have about completed the combination gas and electric light fixtures which are to be placed in the government building at Tyler, Tex. The contract was quite a large one. E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, June 9, 1888.

United States Express Building Plant.

The United States Express Building plant, installed by Messrs. Leonard & Izard, general agents for the Edison Company, was started up this week. The plant is of the three wire system, and consists of 700 incandescent lights. Power is furnished from a Buckeye engine by means of a countershaft.

Standard Underground Cable Company.

The Western sales department of the Standard Underground Cable Company, of Pittsburgh, has been under the management of Mr. F. E. Degenhardt for the past three years. This department comprises all the territory west of the Alleghany Mountains, and to the efforts of Mr. Degenhardt is due the large amount of business done by the department since its establishment three years ago. Mr. Degenhardt has just signed with his company for another three years, a fact which his many friends will be glad to learn. Among other sales made by the company last week are reported the following: Western Union Telegraph Company, Pittsburgh, Pa., 5,120 feet of 61 wire bunches, 14 B. & S. G. Electric Improvement Company, San Francisco, Cal., 6 miles of No. 6 weatherproof wire, 2 miles of which goes to San Jose, Cal. The Newark Electric Light Company, 5,000 feet on No. 4 B. & S. G. electric light wire. Central Union Telephone Company, Quincy, Ill., 1,200 feet of 50 wires No. 22 B. & S. G.

No More Telephones in St. Louis.

A special from St. Louis, dated June 5, states that that city "is threatened with a telephone boycott." "A few months ago the Municipal Assembly passed an ordinance making it a misdemeonor for any telephone company to charge more than $50 a year for the use of an instrument. As the Bell charges were $100 a year, this meant war right off. The company was made a defendant under the ordinance last week and fined $300 for exorbitant charges. To-day the local board of directors of the Bell Company met and resolved to make no more contracts in St. Louis until the constitutionality of the ordinance could be settled. As this may take several years, there is a prospect of the discontinuance of the telephone service." The fight is now going on. The company has taken out a number of city telephones, including the mayor's, and he in turn proposes to cut down poles if the wires are not removed.

W. C. Lyman.

I recently called on Mr. W. C. Lyman, the original inventor of the steam exhaust head, who has spent a number of years in perfecting his device. He states that owing to the great success of his invention a number of others have endeavored to imitate his patent. The value of his invention for saving walls and roofs is apparent, and Mr. Lyman has such confidence in the efficiency of the same that he offers to send heads on trial to any electric light company, the which, if not found satisfactory, are to be returned at his expense. He manufactures a head especially adapted to high-speed engines. A large number are already in use in electric light plants, and he reports many recent inquiries regarding the same. Besides manufacturing the vacuum head, which he especially recommends for electric lighing purposes, he manufactures a cheaper one which is quite extensively used.

Personal.

Mr. A. W. Butterworth, traveling representative of the Callender Insulating and Waterproofing Company, of New York, was a caller at the office of the WORLD this week. Mr. Butterworth has been taking an extended trip throughout the West in the interest of his company, and reports an increasing demand for their well-known insulated goods.

Mr. E. Ward Wilkins, of the firm of Partrick & Carter, Philadelphia, the well-known manufacturers of electrical supplies, made a pleasant call at the office of THE ELECTRICAL WORLD this week. Mr. Wilkins was on his return from an extended trip throughout the West in the interests of his firm. He reports the electrical outlook good.

Arc Lamp Patents.

The following dates from Indianapolis of June 5: An important decision was filed in the Federal Court to-day in the case of Charles F. Brush, of Cleveland, against John Owens and others, in which an infringement of patent was alleged by complainants, testing the validity of what is known as the Jenney system. The opinion, by Judge Gresham, is as follows:

1. The invention shown in the patent sued on was declared in patents 212,183 and 218,208, but in 212,183 the examiner held that Brush's claims were too broad. That decision was acquiesced in, and the invention which was there described, claimed and rejected is now claimed in the patent sued on. The rejected invention was dedicated to the public by acquiescence in the ruling of the examiner, and cannot be claimed in a subsequent patent against others who meantime entered the field and used the rejected invention.

2. The patent in suit is limited to solenoids, and it does not include the common or electro magnet, and thus construed the patent sued on is not infringed by the defendants.

These briefly are the reasons for dismissing the bill for want of equity. The decision is regarded as unusually important, and the case is expected to go to the Supreme Court of the United States.

Well Lighted Streets.

A correspondent sends me the following: The streets of Council Bluffs are lighted by the Thomson-Houston electric lighting system. There are six iron towers, each 150 feet in height, located in different parts of the city, and on each tower there are four arc lights. Each light is of 2,000 candle power. There are also four lights on the Court-House tower. This system of street lighting has been in operation since about the 1st of January, 1888, and so satisfactory has it proved that the number of towers will soon be increased.

The Ohio Centennial.

Mr. Wm. J. Hammer has in conjunction with Messrs. Stuart & Altenburg, agents of the Edison Company in Cincinnati, closed an important contract with the Commissioners of the Centennial Exposition of the Ohio Valley and Middle Atlantic States to arrange a series of novel electric effects, which will surpass anything of the kind attempted heretofore in this country. Mr. Hammer has during the past winter been at St. Augustine as an expert for the Edison Company in conjunction with the celebrated Ponce de Leon plant, and was upon the point of leaving there when he received a telegram from the commissioners calling him to Cincinnati, where he spent two weeks elaborating the ideas and preparing the drawings, which resulted in the contract referred to. This special work is, of course, quite independent of the electrical illumination proper, which will be on an extensive scale, and will include more than half a dozen arc and incandescent systems.

Kearney, Neb.,

is reported to have the finest water power west of Minneapolis, which is supplied by tapping the Platte River above the city with a large canal. A correspondent writes me that the city has an electric light plant run by water which furnishes 32 arc lights for the use of the city, and is now placing an incandescent light plant of the Edison system to furnish 1,000 lights, and in addition power from the canal will be transferred by means of electricity to all parts of the city, and the sewing-machine of the housewife, the roller mills, the elevators, the planing mills, and everything requiring motive power can be furnished by this system at $20 per annum, and when this is compared to steam power at $100 per annum the great advantages of the former are at once apparent. The Western Engineering Company, of Lincoln, Neb., will do the construction work. Sprague motors will be used.

St. Louis.

A correspondent writes me from St. Louis as follows:

The Excelsior Electric Company has just completed the reconstruction of their branch station on Vandeventer avenue, having added forty-five arc lights and an installation of 1,300 incandescents by the Westinghouse Electric Company. They have the contra t for lighting the Kensington Garden Exhibition of the St. Louis Cable & Western Railway. They will establish a large central station of the Westinghouse alternating system the coming season.

The Pike Electric Company have just closed a contract with the St. Louis Wire Mill for a thirty-five arc light plant of the American system, and a fifty light incandescent plant for Ely, Collins & Hale. They are reported to be the successful bidders in behalf of the American Company on a 500-arc light plant with one hundred miles of circuit for the Laclede Gas Light Company. The Cleveland motors, for which the Pike Electric Company are exclusive agents, are fast gaining in popular favor, sales being reported of one one-half, three ones, one five and two seven horse-power, all of their motors now running giving the best satisfaction. Mr. Thomas Grimwood, secretary and general agent of the American Electric Construction Company, New York, has been in the city the past few days. He reports sales by his company of 585 arc lights during the last week of May.

Mr. Norman McCarty, of the Baxter Motor Company, Mr. Guido Pantaleoni, of the Westinghouse Electric Company, and

Mr. Buckley, of the Fort Wayne Jenney Company, are among our latest visitors.

The north nave of the St. Louis Exposition Hall is being beautifully decorated for the Democratic Convention to be held this week, and a chief feature is the artistic arrangement of 600 incandescent lamps by the Heisler Electric Light Company.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.....	$160@	$165	Iowa Union.....	$27@	$28
Central Union.....	47@	48	Michigan.....	79@	80
Chicago.....	375@	400	Missouri and Kansas	70@	71
Colorado.....	19@	21	Rocky Mountain Bell	40@	45
Cumberland.....	65@	68	Wisconsin.....	108@	109
Great Southern.....	35@	40		E. L. P.	

SOUTHERN NOTES.

DALLAS, Tex., June 5, 1888.

Mr. L. R. Colvin, of the Baxter Electric Motor Company, of Baltimore, is traveling in Texas, establishing agencies and otherwise looking after the interests of his company. He reports the outlook very promising.

The Queen City Electric Light Company, of Dallas, Tex., was voted a conditional franchise at a recent meeting of the City Council. The conditions are that they shall furnish in two weeks satisfactory evidence of having a capital of $100,000 paid in; that they shall commence the erection of a brick station by July 15, 1888; that the machinery shall be placed by Aug. 10, 1888, and that the entire plant shall be running and lighting by Oct. 1, 1888, with not less than 250 arcs and 3,250 incandescents. They met with a very vigorous opposition, but finally succeeded in overcoming it. As Dallas has long needed a first-class plant, they will meet with a great deal of encouragement. This has put the old company on their mettle, and interesting times are looked for.

Mr. Parker, of the Brush Company, reports matters as looking very lively. He is very enthusiastic over the merits of the new alternating machine recently put out by that company.

The defunct Pan-Electric Telephone Company, of Dallas, Tex., are taking down their wires and removing their instruments in obedience to the mandate of that august body, the Supreme Court, who, having decided, know no repeal. Thus perishes the fondest hope Dallas ever indulged in. Its sympathies were with the concern, but in vain.

The Heisler Electric Light Company, of St. Louis, recently sold a plant to the Brush Company for El Paso, Tex. This is quite a triumph for the Heisler Company when it is remembered that the El Paso Company was organized for the Brush system.

ENGLISH NOTES.

LONDON, May 23, 1888.

Edison-Swan vs. Anglo-American Brush Co.

The cross-examination of Professor Dewar in the incandescent lamp patent case was commenced upon Wednesday morning and occupied the greater part of the day. The witness exhibited in court a small crucible containing some filaments which it was stated had been carbonized the previous evening without the aid either of charcoal or of sand and without packing or luting of any description. He admitted, however, that the carbonization was not by any means complete, and said that he merely brought it forward as a preliminary experiment to show what could be done in this direction. Mr. Justice Kay could not stand this, and said sharply, "I am very much disgusted, this is clearly an attempt to mislead; I am greatly disgusted, you may stand down." As may be supposed, this vigorous language on the part of the judge created no small sensation in court. Later in the day the Attorney-General, recurring to the incident, explained that Professor Dewar had been misunderstood; the judge, however, seemed unwilling to alter his opinion, and said that Professor Dewar "had made a very unpleasant impression on his mind." Dr. John Hopkinson was recalled by the plaintiffs and gave further evidence relating to the tar and lampblack filaments, and also with regard to the effect of "mounting" before carbonization; he said that this might be done without injury to the platinum wires. Dr. J. A. Fleming, who was also recalled, gave evidence with regard to the first set of Edison lamps which arrived in this country in the beginning of 1880, and which were placed under his charge. This witness had also succeeded in making a practicable lamp with a lampblack and tar filament; he did not think that the decomposition of the tar when the lamp was running would seriously impair the vacuum. On the following day Mr. Joseph Wilson Swan was called to give evidence on the part of the plaintiffs. He said that his attention was first turned to the question of producing light by electricity after hearing a lecture by Mr. Stearn, in Sunderland, in 1845. In 1848 he first succeeded in carbonizing paper in a potter's kiln; he packed the strips of paper in powdered charcoal. Having mounted the filaments in an exhausted globe, he passed a current through, but did not succeed in raising the strips to incandescence. After this he allowed the question to rest until the year 1860, when, by using a more powerful air pump and much larger battery, he made his first fairly successful lamp. It was not, however, until the autumn of 1877 that he took the matter up in earnest, and from that time onwards, with the aid of Mr. Stearn, he continued the experiments until eventually he arrived at a practical and commercial success. Mr. Swan described these experiments in great detail, but he was sure that Mr. Heaviside and Mr. Proctor were in error in stating that they had seen lamps of carbonized cotton thread in his hands in the year 1879. It was not until the middle of the following year that he first showed a thread lamp in public. In cross-examination Mr. Swan admitted that at the amalgamation of the Edison and Swan companies the shares of the United Company were divided in the proportion of 60,000 to the Swan Company and 40,000 to the Edison Company.

The Society of Telegraph Engineers.

At the meeting of the Society of Telegraph Engineers, on Thursday evening last, Mr. Crompton delivered his reply upon the discussion on his paper on "Transformers versus Accumulators." He went into the arguments of the various speakers in great detail, and, although the speech can scarcely be said to have materially contributed to our knowledge of the subject, yet he no doubt succeeded in overthrowing some of the arguments of his adversaries. But upon the whole the general impression appears to be that Mr. Crompton has failed to make out his case on behalf of secondary batteries, because he has yet to demonstrate that the system is either as economical or as reliable as direct current working. At the conclusion of Mr. Crompton's speech, the discussion on Mr. Preece's paper on the "Risks of Fire Incidental to Electric Lighting" was resumed.

Thunderstorm at Glasgow.

Glasgow was visited a few days ago by a thunderstorm of a very exceptional character, in which several people were struck dead in the streets. One local journal says that considerable alarm was caused at the exhibition, several of the visitors being afraid that something terrible would happen in connection with the electric-lighting apparatus. This sapient scribe undertakes, therefore, to reassure "the canny Scot;" he says: "Should the natural electricity find its way to the dynamos, it might cause the light to flare up momentarily, but that is all: the current which drives the lights is quite strong enough to absorb the lightning."

Prof. Elihu Thomson's New Coulomb Meter.

With regard to the ingenious coulomb meter, which has recently been introduced by Prof. Elihu Thomson, my attention has been called to a paper by Prof. E. J. Houston in the *Journal of the Franklin Institute* for December, 1887, in which a meter designed by Mr. Joseph Taverner is described at length. This meter is protected by an English patent, No. 123, 1884, and it is so singularly like that of Prof. Thomson, that it would be interesting if that gentleman would explain wherein the difference lies.

A New Alternating-Current Motor.

Professor Ferraris, of Turin, is at work upon an alternating-current motor founded upon a new principle, which consists in the employment of two separate and distinct alternating-current circuits, so placed that their magnetic fields are situated at right angles to one another. The phases of the currents in these two circuits are displaced relatively to one another by an interval of a quarter period. The consequence is that the point of maximum intensity of the resultant field will describe a closed curve in space. It remains to be seen whether the principle will lend itself to the production of motive power, but in any case it appears certain that a reliable motor might be based upon this reaction.

New Electrical Instruments.

At a "conversazione" given last week by the Master and Wardens of the honorable company of Salters professors, Ayrton & Perry exhibited the latest form of secohmmeter, which has now been reduced to a very practicable and handy shape. It is intended to be used with standards of self-induction, so as to obtain the coefficients of any coil compared with that of the standard, and for this purpose no speed-counter is required. The same inventors exhibited the Maxwell galvanometer, which is really an improved form of the well-known D'Arsonval instrument, in which, by the addition of several small permanent magnets mounted upon the movable coil, the deflections are rendered independent of the strength of the field of the controlling magnet.

The Jarman Electric Tramcar.

A report has just been issued of some so-called tests of the Jarman Electric Tramcar. The subject would scarcely be worth referring to but for the possibility that this individual, whose persistent efforts have hitherto failed in this country, may seek name and fame in America. The peculiarity of the Jarman system consists solely in the brilliant idea of employing two separate and distinct motors, one to drive the car forward and the other to drive it backward. The inventor claims that in this way opportunity is afforded to each motor of alternately cooling down. It is hardly necessary to point out that any motor which requires cooling down at frequent intervals is simply unfit for its work. The report in question gives some details with regard to the speed of the car, the E. M. F. and the current, but as no figures are given as to the weight of the car or as to the gradients on the line, it is impossible to make much out of them.

Royal Society Soiree.

A highly successful "conversazione" was held last Wednesday evening at the rooms of the Royal Society, at which several pieces of apparatus were shown of great interest to electricians. Perhaps the most beautiful exhibit was Mr. Shelford Bidwell's apparatus, used by him in his researches on the elongation and retraction of magnetic metals in powerful fields. So marvelous is the delicacy of the observations made when employing this apparatus, that a variation in length of $\frac{2.5}{1,000,000}$ of an inch is easily seen. Almost on a par with this instrument is Mr. Vernon Boys' electric "radiomicrometer," furnishing the most delicate means hitherto devised of measuring minute variations of temperature. Prof. Forbes exhibited an improved form of his coulomb-meter, in which the slight tendency of the vanes to rotate after the breaking of the circuit is ingeniously counteracted. Amongst other exhibits were miners' lamps, a writing telegraph, a large Wimshurst machine, a new photometer, and some "adamant" carbon. This last was shown by Messrs. Woodhouse & Rawson. It is a carbon of extreme hardness, made by a secret process, and capable of taking a jet-like polish; it is reported to give good results in the Blake transmitter. During the evening, Dr. Marcet treated the assemblage to his striking experiment of throwing a magnified image of an ordinary electric spark upon a screen; the spark then appears as nothing more or less than a miniature flash of lightning.

LONDON, May 30, 1888.

Sir W. Thomson at the Society of Telegraph Engineers.

Sir William Thomson received a most enthusiastic reception on his appearance at the Society of Telegraph Engineers on Thursday evening last, when he delivered an address upon his well-known "electrical balance instruments." These instruments have been before the electrical world for some time past, and therefore there is no need for me to give you a detailed description of them. I may, however, recall the fact that the series is capable of measuring from one-half of one centi-ampère up to 500 ampères, with an error in each case not exceeding $\frac{1}{10}$ per cent. Your readers are probably aware that Sir William Thomson's communications (except such as are read before the British Association or the Royal Society) are usually made in the first place to the Physical Society of Glasgow, in the University of which town he occupies the chair of Physics. Consequently his visits to the Society of Telegraph Engineers are few and far between, and are, therefore, the more highly appreciated when they take place.

Electrical Festivities.

On the following day Sir William Thomson dined with the "Dynamicables," when a very pleasant and lively evening was spent. Professor Forbes contributed to the success of the proceedings by giving a sketch entitled "Five minutes with American Electricians," which was highly appreciated. The same evening a "a conversazione" was given at the Finsbury Technical College, when Professor Silvanus Thompson lectured upon the "Polarization of Light" and showed some magnificent chromatic effects which greatly delighted his audience. Professor Perry also delivered a lecturette upon the magnifying spring, which is so well known in connection with the Ayrton & Perry ammeters and voltmeters. By an ingenious combination of two springs, having different diameters and different pitch, the inventors have succeeded in magnifying a rotary as well as a longitudinal motion. This combination promises to assume a very high importance in connection with instruments of precision.

A New Goolden Dynamo.

Messrs. Goolden & Co., of Halifax, have recently built a 50-kilowatt dynamo, in which a special device is employed in order to obtain a slight longitudinal to and fro play of the armature for the purpose of varying the surface of the commutator upon which the brushes bear. This is effected by an ingenious device, consisting of a couple of papier maché wedge-shaped discs mounted eccentrically upon the armature shaft, in such a way that when the machine is running at full speed they revolve relatively to one another about twice in a minute. The armature is thus made to rock to and fro at the same rate for a distance equal to the difference in the thickness of the two opposite halves of the disc. Of course, a device of this character would be of no use for small machines, and it remains to be seen whether the game is worth the candle, even in the case of the largest types.

Electric Lighting Progress in the Provinces.

The movement amongst the provincial corporations in favor of electric lighting still continues. The local authorities at Poole and Ilfracombe are advertising this week for tenders for electric lighting, and at Bath and Exeter the town councils have recently passed resolutions in favor of its introduction.

Edison-Swan v. Anglo-American Brush Corporation.

The law courts only reassemble this morning after the Whitsun holidays, consequently I have nothing to report this week in connection with the litigation over the lamp patents. The cross-act on brought by the Anglo-American Brush Corporation against the Edison-Swan Company for the alleged infringement of the Lane-Fox patents will come before Mr. Justice Kekewich in another court in a few weeks time.

The Copper Ring.

There is a strong impression in many quarters that we are on the eve of a fall in the price of copper. The visible supply is augmenting week by week, and this results not only from the increased output but also from a very decided diminution in the demand. Wherever possible mild steel or iron is being substituted for copper, and it is to be expected that in many cases the market for copper will be entirely lost. The railway companies have been breaking up large quantities of old locomotives, and are able to get a much better price for the old copper and brass than they originally paid. It is also noteworthy that the price of copper for delivery in three months is now several pounds per ton lower than the immediate market price. This is a highly significant symptom; but then it must not be forgotten that the Paris syndicate is an extremely powerful combination, and it is certain that they will leave no stone unturned in order to win their game. It is, therefore, probably unsafe to place too much reliance upon the prospect of a speedy fall in prices.

The Leamington Central Station.

It is understood that a large secondary battery is to be placed in the Leamington central station, and it is to be hoped that this will prove a solution of their difficulties.

Medical Electricians.

Electricity has of late years been responsible for many novel developments, but I doubt if it ever gave rise to a stranger phenomenon than "an unlimited company without specified capital." Such, however, is the description of the "British Association of Medical Electricians." The objects of this high-sounding association are stated to be to promote and encourage the study and practice of medical electricity. Over this philantrophic work Mr. C. B. Harness, of medical-battery fame, and Prof. Carter Moffatt, the inventor of the ammoniaphone, are to preside, and under the ægis of these gentlemen what is impossible?

THE TELEGRAPH.

Tennessee.—The Midland Telegraph Company has been formed by T. C. Leake, Jr.; J. Overton, Jr.; D. T. Porter, and others, to build a line along the Tennessee Midland Railroad.

A Cable Deficit.—The Pouyer-Quertier cable report for 1887 reveals a loss of 1,000,000f. This is partly due to repairs made, but the working expenses exceeded the earnings by 300,000f.

A Western Union Purchase.—The sale of the Fort Worth & Denver Telegraph Company to the Western Union is announced. The line extends from Fort Worth to Denver, and is the only telegraph line running northwest from the Pan Handle. The terms were private.

A Correction.—Through inadvertence, a note on Mr. P. B. Delany's new system of cable transmission was made to read as if all signals were sent from the same side of the battery. As the description showed, it was intended to say that the charges of opposite polarity were of the same duration for all signals.

Mexico.—The Mexican Pacific Coast Railway Company has been formed in this State by a number of well-known men to con-

struct a railroad and a telegraph line through the States of Jalisco and Sonora, Mexico, with Californian connections. Among those interested are ex-Secretary Windom and Col. R. G. Ingersoll.

Canadian Bucket Shops.—A special dispatch of June 5 from Montreal says: It is stated that the bucket shop proprietors have taken legal opinion as to the operation of the bill against them, and that a plan has been prepared by leading counsel which enables them to transact business without coming under the provisions of the act.

A Government Cable.—A special dispatch from New Bedford of June 5 says: The steam tug Nellie left here this morning for Wood's Holl to lay a submarine cable from Wood's Holl to Naushon, which is to be part of the government cable to be laid from Pasqua to Gay Head, the connection across Robinson's Hole to be laid later.

THE TELEPHONE.

Alabama.—A company has been formed to build a telephone line from Troy to Montgomery.

Newark, O.—The telephone exchange at Newark, O., was struck by lightning on May 27. The apparatus was badly damaged, and the service was suspended.

The Cushman Telephone.—The infringement suit of the American Bell Telephone Company against the Cushman Telephone Company is now being heard at Chicago, before Judge Blodgett, in the United States Circuit Court. It is said that the hearing will occupy a couple of weeks.

The Chinese Syndicate.—Papers have been filed in Philadelphia in the suit for $18,000 of Count Mitkiewicz against Mr. Wharton Barker, in connection with the famous Chinese telephone and banking syndicate, which was to operate under a very favorable concession from the Chinese government.

Metropolitan Stock.—The Metropolitan Telegraph and Telephone Company has sold $2,000,000 1st mortgage, 30-year gold 5s to Messrs. Lee, Higginson & Co., who offer them at par and interest. This company is a licensee to the American Bell Company, and operates in New York city and county. The American Bell Company controls the stock, which pays a large dividend from net earnings of $600,000 per annum. The mortgage provides for a 1 per cent. sinking fund beginning in 1890, and bonds may be bought up to 110 and interest, but cannot be drawn.

Want the Apparatus Destroyed.—The American Bell Telephone Company, in the United States Circuit Court, this city, on June 6, before Judge Wallace, applied for a decree ordering the destruction of telephone apparatus owned by Willian T. Kitsell, besides an injunction and damages against the same. Kitsell was sued about a year ago and defaulted. The Bell Company claimed that it had obtained such a decree in New Orleans, and that it was necessary to render effective its patent. Counsel for Kitsell argued that such an order would be unconstitutional; that the Bell Company had no patent for transmitters and receivers, but only for the process, and that these latter were Kitsell's property. Kitsell owned the Hotel Madison, and used the instruments there, which are old-fashioned. His counsel says that he never manufactured them for public service.

THE ELECTRIC LIGHT.

Natchez, Miss.—The Natchez Gas Light Company will put in an electric light plant.

Tuskaloosa, Ala.—The Tuskaloosa University is negotiating for an electric light plant.

Buffalo Gap, Wyo. Ty., is to indulge in the civilized convenience of an electric plant.

Blue Springs, Neb.—A franchise for electric lighting has been granted to A. Stewart and O. Richards.

Maysville, Ky.—It is said that Mr. King, representing the Edison system, is likely to put in a plant at Maysville.

Port Deposit, Md.—Mr. J. M. McClenehan and others are taking steps to organize a local electric light company.

Merced, Cal.—Mr. A. C. Swain has, it is reported, gone East to select and purchase a lighting plant for Merced.

Ithaca, N. Y.—Sealed proposals are wanted for the electric lighting of the city of Ithaca for terms of three or five years from Dec. 31.

Taunton, Mass.—The local electric light company has declared a 6 per cent. dividend, and is about to largely increase its facilities.

Quindaro, Kan.—The National Water Company is installing a Brush 50-light incandescent plant in its pump-house at Quindaro.

Jacksonville, Fla.—Bids for a plant for electric lighting are wanted at Jacksonville, and should be addressed to Mr. W. Henry, Mayor.

Dallas, Tex.—It is reported that the Dallas Electric Light Company will, from first to last, spend about $40,000 in developing its plant.

Atlanta, Ga.—Electric light plants are being put in the Marsham House, and in the cotton-seed oil mill owned by the American Cotton Oil Trust.

Camden, Ark.—A company has now been formed to put in a plant at Camden, providing sufficient support can be secured. Mr. W. F. Avera is interested.

Brockport, N. Y.—A local Thomson-Houston Company, with a capital stock of $15,000, has been incorporated at Brockport by G. D. Morgan, H. N. Beach, G. C. Gordon and others.

Raleigh, N. C.—The Raleigh Gas Light Company are preparing to erect a building for their electric light plant. They have purchased a 60 horse-power engine and another dynamo.

Gainesville, Ga.—The Gainesville Light Company has been organized, and will erect an electric light plant at once, machinery having been ordered. S. C. Dunlap is president; J. W. Smith, vice-president, and E. H. Jewell, secretary and treasurer.

Hoosic Falls, Mass.—The Hoosic Falls Electric Light and Power Company has been incorporated by F. Sawyer, J. W. Wakefield and F. H. Twitchell, with a capital stock of $40,000.

Rockaway, L. I.—The Thomson-Houston Electric Light and Power Company, of Rockaway, has been incorporated by the indefatigable J. J. Moore and others, with a capital stock of $75,000.

Eau Claire, Wis.—Contracts for lighting the city for five years with 70 arcs of 2,000 c. p., or 300 incandescents of 25 c. p., should be addressed until June 15 to D. McKinnon, chairman of the lighting committee.

Winchester, Ky.—The Winchester Electric Light and Power Company has been formed by J. D. Simpson, S. D. Kerr, A. H. Hampton, A. Stewart, H. P. Thompson, and others. The Edison system will be used. The capital stock is stated as $15,000.

Shelter Island, N. Y.—Mr. F. R. Chinnock, Long Island agent for the Edison system, has closed a contract for lighting the well known seaside resort, Shelter Island. The company proposes to put in 2 dynamos of 300 lights each, and to supply lights to the Prospect Hotel and to cottages, as well as to undertake street lighting. It is also contemplated to run a merry-go-round by Sprague motor.

Evansville, Ind.—The Citizen's Electric Company, of Evansville, has been organized by 25 residents of that place, with a capital stock of $100,000, intending during the year to erect a Westinghouse plant of 2,600 lights of 16 c. p. At the present time there is a little difficulty and conflict owing to the fact that the city council hesitates to grant the right of way. The opposition is said to come from the present gas company. Mr. A. Dyer is one of the parties interested.

Garden City, Kan.—The Garden City Electric Light, Heat and Power Company was chartered some time ago, and organized with S. M. Heller, Napoleon, Ohio, as president, J. L. Trout, of Garden City, vice-president, and A. T. Moon, secretary, treasurer and general manager. The company will at once put in plant comprising both arc and incandescent systems of lighting. All communications on the subject should be addressed to Mr. Moon, Lock Box 685, Garden City.

Electric Lighting Contracts.—It was stated by the New York daily papers last week that a suit would be brought to set aside the city contracts lately awarded for electric lighting, on the ground that a bid of the New York Electric Illuminating Company, the lowest, was withdrawn, although the Gas Commission had no power to allow that action. The company now, it appears, regrets the withdrawal, and asks for the setting aside of the contracts as well as a readvertising for tenders.

The Boston Edison Plant was not long in resuming after its suspension by fire last week. The fire broke out on Saturday morning, but in 19 hours the station was running again, and on Monday morning, June 4, it started off at full load. Mr. Edgar, the energetic young superintendent, was aided by Mr. J. H. Vail, the general superintendent of the parent company's engineering department, and so prompt was the resumption, that by Monday afternoon the insurance had been adjusted for $33,500.

Westinghouse Plants.—The Westinghouse Electric Company, of Pittsburgh, report the building of a large number of new plants, and also state that the business for the central station opens much earlier than in any previous season, contracts being usually deferred until late in the season, when the days become shorter. Among their new plants are those of Palmer, Mass.; Pittston, Pa.; Passaic, N. J.; Little Rock, Ark.; Oakland, Cal.; San Bernardino, Cal.; Newark, O.; Salem, O.; Hagerstown, Md.; Troy, N. Y.; Conshohocken, Pa.

The Hill Clutch Works, of Cleveland, O., have just been awarded the contract for the complete electric lighting station, at St. Paul, Minn., including the building. Although their bid was fully 25 per cent. higher than their competitors, the merit of their designs, and of the quality of the work they proposed to furnish, as well as their established reputation for high class engineering, secured them this large contract. St. Paul will have a model plant. The Hill Clutch Works are also designing an electric light plant for Ionia, Mich., which they are to put in shortly.

Fixing the Responsibility.—The coroner's jury which has been engaged in this city for two or three weeks past in investigating the death of a lineman who was killed by shock in attending to "trouble," has brought in a verdict to the effect that the local Brush Company is responsible. The jury condemn "the parsimonious spirit of the electric light companies" in not keeping their wires well insulated, and recommend the Coroner to call the attention of the District Attorney to the subject. It is said that the Mayor, whose collision with the jury will be remembered, narrowly escaped censure.

All Night Lighting.—Places about to make contracts for electric lighting should not overlook a point brought forward by the Newburyport (Mass.) *News*. It appears that the arrangement of that town with the electric light company contains no provision for lighting the streets after midnight. This omission *The News* very properly condemns upon the ground that such lighting is essential to the speed and safety of a fire engine in answering an alarm. The importance of saving every minute at the outbreak of a fire is so universally recognized that it would seem only needful to call attention to the danger to have it remedied in any wideawake community.—*Fire and Water.*

St. Louis, Mo.—The northern nave of the Exposition Building in St. Louis, which has been transformed into the great hall for the great Democratic National Convention and great National Saengerfest, with a seating capacity of over 16,000, is illuminated by the Heisler system. The first trial illumination took place on the 2d of June. The effect was found most beautiful and pleasing. The hall is of a length of 350 feet and of a breadth of 100 feet. Sixteen fixtures, holding seven 30 c. p. lights and eight fixtures holding thirteen 30 c. p. lights, suspended at a height of about 40 feet over the audience and about 30 feet over the platform, illuminate the main portion of the hall. About 100 brackets and single-drop lights are distributed in the aisles and galleries, in which are also placed the lights of the original isolated plant of the building.

APPLICATIONS OF POWER.

Richmond, Va.—The Manchester Railway and Improvement Company has received a permit to operate an electric road.

Attleboro, Mass.—The Electric Light Company is about to build an electric railway, which will be put in by the Thomson-Houston Company, using the Van Depoele system.

Scranton, Pa.—A road is to be built by the South Scranton Electric Railway Company, and the contract has been awarded to the Metallic Street Railway Company, of Albany, N. Y.

Southington, Conn.—The directors of the Southington & Plantsville Tramway Company have inspected the Derby Electric Company's plant, with a view to adopting the same system for their road.

Waterville, Me.—P. S. Heald has put in an electric motor to run his sewing machines. Noyes & Goddard have also put a motor in their stove foundry. In both cases, thus far, they give the best of satisfaction.

Brooklyn, N. Y.—The Brooklyn Common Council has granted permission to the Brooklyn City Railroad Company to run five electric motor cars over the tracks on Third avenue, from Twenty-fifth to Thirty-ninth street. The company expects to substitute electricity for horses.

Baxter Motors are reported in good demand in New York, New England, the West and the South. The company has issued recently a pithy and admirable little circular "How to Order Elevator Motors." It shows how much careful work is being done in developing the motor field in the right way.

New England.—Plans to form the Revere, Mass., electric street railway have been maturing for over a year, and the work of construction will begin in a few days. The West End road will probably introduce the power on its suburban lines, like the Arlington, Newton & Brighton division, and it is said that Mr. Whitney is now making the necessary arrangements.

Cheap Power for Mining.—It is stated that a company is about to start electric works on Deer Creek, below Nevada City, to be run by water power. It will be sent to those mines in Grass Valley and around Nevada City that are not in reach of water power. This electric power, generated by water-wheels and dynamos, is next in cheapness to water-power itself. Several mining companies agree to take the electricity.—*Chic. Jour. Com.*

The Aldermanic "Combine."—It appears that the recent actions of the New York Aldermen in regard to electric railway and other franchises are likely to be explained. Specific charges have now been brought in the District Attorney's office, for bribery and corruption, against Alderman Dowling, who has been so strong in his opposition to the Julien storage car. The matter will go before the Grand Jury, to whom Judge Barrett has already delivered a special address on the subject.

The Brooklyn Heights.—The Brooklyn Heights Railroad Company, of which S. B. Chittenden, Jr., is President, has applied to the Brooklyn Common Council for permission to operate an electric road through Montague street, from Court street to Wall Street Ferry. There is already a petition from the Wall Street Ferry Railroad for a franchise for a cable road over the same route. To this many of the property owners objected, and they are the ones represented in the Brooklyn Heights Company. In the petition of the latter company it is claimed that the owners of $2,265,000 out of the $3,429,00 worth of property on Montague street favor the electric road. Both petitions will be considered by the Railroad Committee.

Brockton, Mass.—A special dispatch from Brockton of June 4 says: In the board of aldermen, this evening, the Brockton Street Railway Company, of which W. W. Cross, of this city, is president, and Asa P. Potter, of Boston, is one of the principal shareholders, petitioned for permission to use the Thomson-Houston electric system as a means of propelling the cars, instead of horses, the overhead system, so called, being desired. The directors of the East Side Street Railway in part were also present for permission to adopt the Sprague overhead electric system for this new road. An order was introduced allowing the Brockton Street Railway Company permission to use electricity, the system to be subject to the approval of the board of aldermen. The petition of the East Side company was finally granted.

Aberdeen, Dak.—A special dispatch from Aberdeen, Dak., of June 9 says: Great excitement was caused here yesterday by the efforts of the citizens to prevent men and teams employed by the Electric Motor Company from plowing up the main street for the construction of an electric motor line. Drays were driven across the street to stop the teams. A great crowd gathered and cheered the citizens upon the drays. The City Marshal ordered the drays away, but the citizens returned to the attack with an order from the Mayor prohibiting further work. The franchise was granted in April, 1887, with provisions requiring the consent of the property owners along the line. This was not obtained, and the city asserts that the right under the charter expired June 6, no consent having been obtained. The company asserts that the provisions of the city charter apply only to horse car lines, and not to the motor line.

PERSONALS.

Mr. Thos. A. Edison contributes an interesting article to the *North American Review* for June, in which he tells the story of his wonderful invention, the phonograph, and describes with particularity a number of the uses to which it can be put. Mr. Schuyler S. Wheeler also has an excellent article on the perfected phonograph in *Harper's Weekly* for June 9, in which the physical basis of the apparatus is admirably explained.

The Duke of Marlborough is profoundly interested in everything of a mechanical or electrical nature. One of the first things he did on arriving in this country was to go up the Hudson and see the Poughkeepsie bridge. On his last visit here he had a long talk with Edison about his inventions, and will make him another visit before he goes home this time. He conducts all his correspondence on an American type-writer, which he

handles with considerable skill, carrying the machine around with him wherever he goes, precisely as he does his hat box or his valise.—*Mail and Ex.*

BUSINESS NOTICES.

Domestic Electric Plants.—C. L. Levey, 49 Broadway, N. Y., is offering small plants with an automatic engine, etc., complete at prices that reduce this light to one-quarter that of gas.

The Partz Electric Battery Company, of 1,723 Chestnut street, Philadelphia, have three batteries which they make a specialty of, namely, a motor, acid gravity and open circuit. Send for their catalogue. The results of three years' use are simply marvelous.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Kidder Batteries.—This business letter is from Robert A. Reid, M. D., editor of the *Massachusetts Medical Journal:*

BOSTON, June 9, 1887.

Jerome Kidder Manufacturing Company:

GENTLEMEN: I have one of your tip batteries which I have used for upward of five years, and for the first time I find a repair needed. I believe that for range, regularity and smoothness of current and therapeutic scope, your battery is unsurpassed; while for convenience it certainly has no equal. If I can insert the platina plate myself, please send it and I will remit promptly.

Yours very truly, ROBERT A. REID.

"Steam Boilers."—The Pond Engineering Company, of St. Louis, have just issued a neat little brochure on "Steam Boilers Practically Considered," which will be sent to any address upon application. It contains a remarkably large amount of interesting and valuable data on the subject.

MISCELLANEOUS NOTES.

The Quadrite Electric Company, of New York, has been incorporated by J. Tepper and others, with a capital stock of $10,000.

The Kookogey Electric Company, of New York, has been incorporated by W. P. Kookogey and others, with a capital stock of $10,000.

The Barriett Electric Apparatus Company, of New Orleans, has been incorporated by S. L. Barriett and others, with a capital stock of $10,000.

The New Armature Protector, described in a recent issue, is the invention of Mr. C. D. Wright, of Petersburg, Ill., and not of Mr. C. G. Wright, of Chicago.

New York City.—The Roome Protective Company has been formed in this city, with a capital stock of $100,000, by H. C. Roome, A. B. Bennett and J. N. Ashley.

The Cincinnati "Centennial."—Press headquarters at the Centennial buildings have already been established and we have to acknowledge receipt of a very cordial invitation to be present at their opening on June 9, from the Cincinnati Press Club.

Communication with Lightships.—Several of the largest New York shipping merchants are promoting a plan to establish telegraphic communication between shore and the lightships along the coast. It is hoped to carry out the scheme by the summer of 1890.

New Jersey Taxes.—The State Board of Assessors has filed its first return of taxes on the miscellaneous corporations of the State. Bills have been made out against gas and electric light companies taxed upon capital stock for $24,000, and telegraph and telephone companies for $9,000.

American Institute of Electrical Engineers.—A meeting of the Institute will be held on Tuesday next, June 19, at 8 P. M., at Columbia College, when Mr. Frank J. Sprague will read a paper on "The Solution of the Municipal Rapid Transit Problem." The paper will be elaborately illustrated, and will, undoubtedly, be of the utmost interest and importance.

Buffalo Electrical Society.—At the last meeting of the Buffalo Electrical Society, Dr. Henry R. Rogers, of Dunkirk, N. Y., gave a discourse on "The Great Cosmical Problem, or Electricity on the scale of the Universe," in which he dealt with the correlation of forces, and undertook to show that every conceivable form of force was identified with electricity, as the grand universal power which sways all things.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

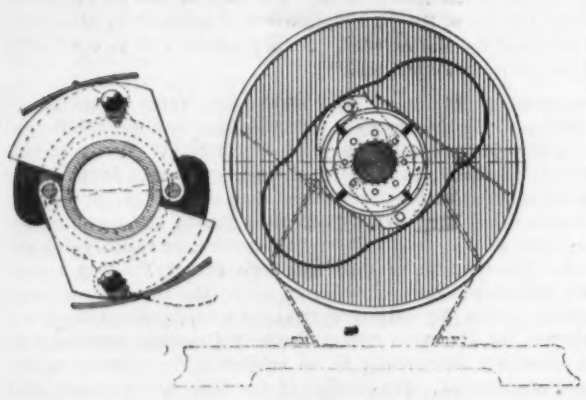
PATENTS DATED JUNE 5, 1888

383,857. Governor for Electro-Magnetic Motors; Charles F. Brush, Cleveland, O. Application filed Aug. 1, 1887. Improvements in governors for electro-magnetic motors, in which an endless spring is mounted on and made to embrace the governor-weights. The weights are mounted on links of the crank variety, and are pivotally connected with the commutator sleeve, with the arrangement of parts such that a limited outward movement of the weights is sufficient to rotatively advance the commutator sections from maximum to minimum points of effectiveness, to the end that a prompt action and a wide range of governing capacity are attained. See illustration.

383,863. Magnetic Separator; G. Conkling, Glens Falls, N. Y. Application filed Sept. 23, 1887. Two endless aprons or belts run transversely of each other; one carries the pulverized ore, and as it passes beneath the other the ore is attached to it by reason of a magnetized plate beneath it.

383,891. Cut-Out for Incandescent Lamps; Hermann Lemp and Merle J. Wightman, Hartford, Conn. Application filed June 21, 1887. An incandescent lamp having its entering conductors brought into proximity electrically in the space between the legs of the filament, and continued in such proximity substantially the whole height of the filament, whereby they may be electrically united by fusion under the influence of the arc formed between the broken ends of the conductor upon the rupture of a filament.

383,898. Stock for Skeleton Burners for Incandescent Lighting and the Art of Making the same; Eugène Moreau, Philadelphia, Pa. Application filed Feb. 20,



383,857. GOVERNOR FOR ELECTRO-MAGNETIC MOTORS.

1888. Sheet material is stamped out to form a net work, which shall be more even than a woven fabric can be made. It is used for incandescing burners.

383,899. Electro-Therapeutic Battery; Edward John Murphy and John Floyd, Lynchburg, Va. Application filed Feb. 16, 1888. A battery of zinc and copper with an excitant is placed in the hat to cure headache.

383,901. Electric Power Controller; Gustav S. Neu, New York, N. Y. Application filed Jan. 27, 1888. A catch is arranged to restrain a self-acting supply valve. A vibrating hammer trips the catch, when it is operated by an electro magnet whose circuit is closed automatically.

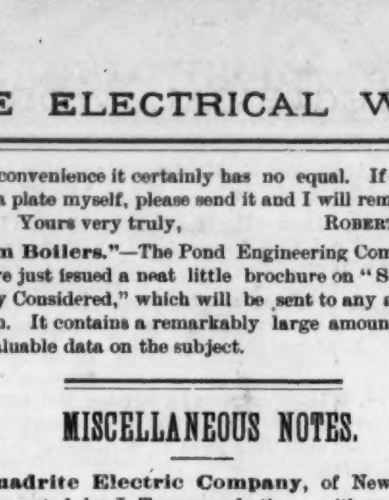
383,913. Rheostat; E. Wilbur Rice, Jr., of Lynn, Mass. Application filed Feb. 4, 1883. A series of conducting pins or studs projecting inwardly from a suitably-supported plate, a second set of pins arranged parallel with the first, but insulated therefrom, a continuous resistance strip or wire strung upon the two sets of studs and bridging the space between the two sets, and a series of switch-contacts cast in one piece with the conducting pins and arranged upon the outer face of the support. See illustration.

383,918. Magnetic Separator; Michael Holroyd Smith, Halifax, County of York, England. Application filed Oct. 29, 1887. Patented in England Aug. 9, 1887, No. 10, 893. In a suitable casing there is located a magnetic ring and within it is a revolving cone which drives the pulverized mass of ore against the ring by centrifugal action. The iron particles are held in contact with the ring while the remainder drops free. See E. W., Dec. 31, 1887.

383,919. Insulated Wire; Henry Splitdorf, of New York, N. Y., Assignor to the Splitdorf Wire Company, of same place. Application filed Nov. 12, 1887. Asbestos fibres are applied to the conductor in the form of a flat, untwisted thread.

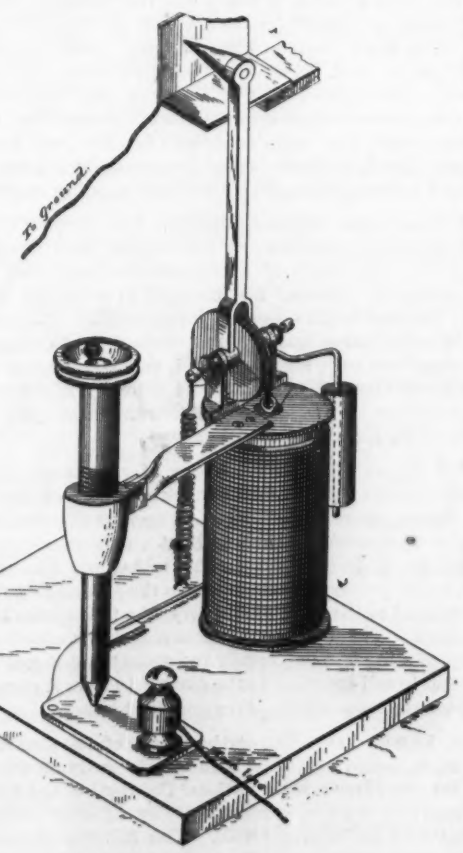
383,933. Switch or Cut-Out for Electric Circuits: James J. Wood, Brooklyn, N. Y. Application filed May 28, 1887. A modified form of the switch in which the first movement of the lever compresses or stores power in a spring, and a further movement thereof trips a latch and allows the spring to throw over the contacts, making a quick make or break.

383,941. Electric Signaling Box; Walter D. Browne, of Seneca Falls, Assignor to Fred C. Timpson, of Auburn, N. Y. Application filed Sept. 17, 1887. A hollow reversible carrier provided with a diaphragm constituting a partial division wall



384,200. MAGNETO-ELECTRIC LIQUID LEVEL INDICATOR.

across the carrier, a weight of finely divided material, two connected movable heads inclosing the weight, and a circuit making and breaking device actuated by the weight and moving with the heads. The box operates by gravity.



384,042. LIGHTNING ARRESTER.

384,035. Electro-Magnetic Separator; Joseph B. Hamilton, Springfield, Mass. Application filed Feb. 2, 1888. A construction whereby a large amount of magnetized surface is exposed to the pulverized ore.

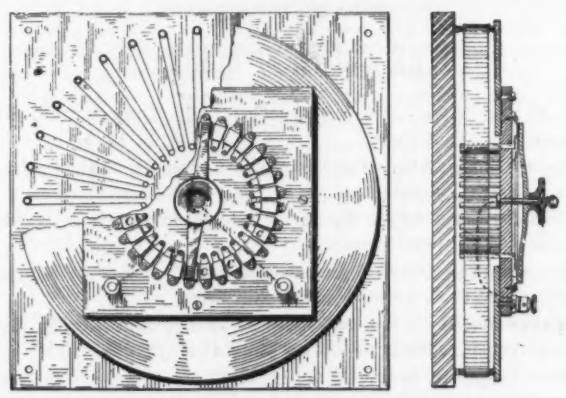
384,042. Lightning Arrester; P. O. Kielholtz, Baltimore Md. Application filed Feb. 8, 1888. A magnet of high self induction, but low ohmic resistance, is used to shunt an excessive current into a branch connected through a short air space with ground. See illustration.

384,044. Rheostat; Walter H. Knight, New York, N. Y. Application filed April 10, 1888. An electric resistance composed of metallic plates held in permanent superficial connection and stationary relatively to one another, while the contact device is movable relatively to the whole series, and by sweeping over the plates brings more or less of them into circuit.

384,077. Dynamo-Electric Machine or Motor; Andrew L. Riker, New York, N. Y. Application filed Nov. 25, 1887. Each core and pole is in one piece, being drop forged from wrought iron. The core is cylindrical in form. The pole is approximately the form of a semi-cylinder with its inner surface concaved to correspond with the curvature of the ring armature.

384,088. Electric Annunciator; Charles E. Scribner, of Chicago, Ill., Assignor to the Western Electric Company, of same place. Application filed Dec. 27, 1886. Means for giving two signals depending upon reversals of current. Current in one direction will drop one shutter and a reversal will drop two.

(1) 384,116, (2) 384,117. (1) Electric Shunting Device; (2) Governor for Electric Motors; Wm. Baxter, Jr., Baltimore County, Assignor to the Baxter Electric Manufacturing and Motor Co. of Baltimore, Md. Applications filed, respectively, Aug. 20, 1887, and Aug. 27, 1887. (1) The different sections of an electrical current are connected with a series of yielding springs. The latter are sustained with their flat sides adjacent, and a metallic block is arranged to move in succession over the yielding ends of the springs. (2) The shunt box is placed directly



383,913. RHEOSTAT.

upon the bridge between the pole pieces, so that short and direct connections may be made from the field coils.

384,152. Demagnetizer; John Greaves, St. Louis, Mo. Application filed Aug. 15, 1887. The currents through the magnets are reversed or alternated as a cylinder is turned.

384,200. Magneto-Electric Liquid Level Indicator; John J. Ghegan, Newark, N. J. Application filed Sept. 5, 1887. In magnetic circuit controllers for liquid level indicators, a movable permanent magnet whose motion in one direction is limited by a non-magnetic stop and in the opposite direction by an electric contact-point. See illustration.

384,201. Telephone Transmitter; Ezra T. Gilliland, Boston, Mass., Assignor to the American Bell Telephone Co., of same place. Application filed Sept. 19, 1885. Patented in Belgium, Jan. 27, 1886, No. 71,772, and in England, Jan. 29, 1886, No. 1,310. The diaphragm of a powdered carbon transmitter is held constantly in a horizontal position, no matter what movement is given to the bracket supporting the transmitter.

384,222. Relay; John E. Watson, Louisville, Ky., Assignor to the International Electric Company, of same place. Application filed April 11, 1887. Patented in Belgium April 12, 1887, No. 77,046. This involves the overcoming or neutralization of the extra currents set up in the main line by means of opposing coil induction effects in the relay instrument, the armature of such relay instrument being normally counter-balanced or poised by tension against the magnetic attraction of its electro-magnet, which involves two helices on the same core relatively of high and low resistance, and respectively connected in the main line and a constantly closed local circuit, said main line passing its current in reverse direction to the current of the closed local circuit.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.